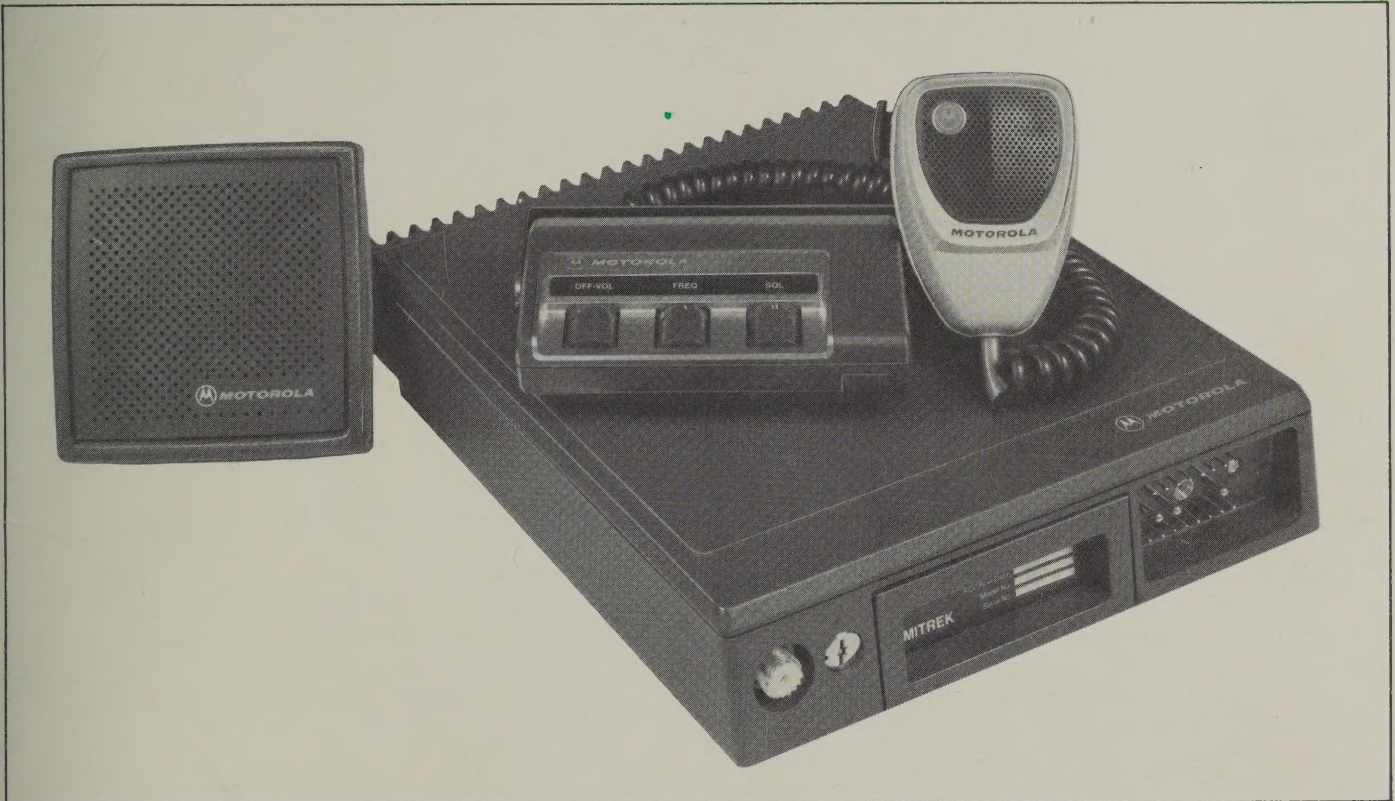




MITREK™

Two-Way FM Radio

136-174 MHz
40/60/75/110 Watts



Instruction Manual

68 P81045E70-O-01

OPERATION

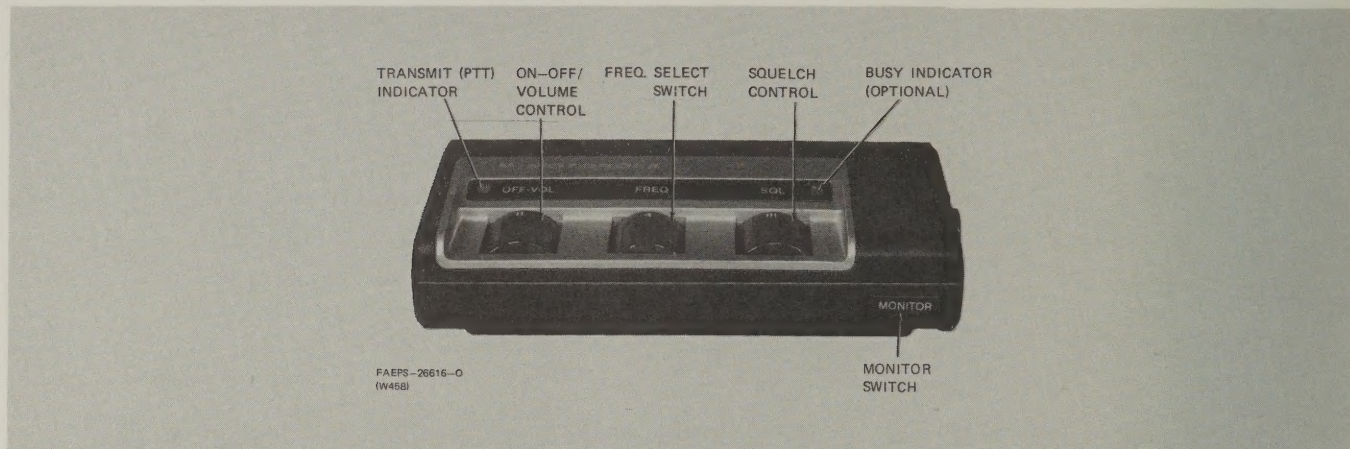


Figure 1. Operating Controls

1. RECEPTION

Step 1. Set the control head ON-OFF switch to the ON position. The receiver operates continuously while the radio is turned on.

Step 2. Select the desired radio channel.

Step 3. On "Private-Line" or "Digital Private-Line" radios remove the microphone or handset from its hang-up box. The receiver now operates with carrier squelch. All signals on the selected channel can be heard.

Step 4. Turn the SQUELCH control fully counterclockwise. Adjust the control head VOLUME control for a comfortable listening level.

Step 5. Turn the control head SQUELCH control clockwise until the speaker noise stops.

Step 6. Replace the microphone or handset in its hangup box. If your radio is equipped with tone "Private-Line" or "Digital Private-Line" coded squelch, the receiver will now operate in the coded squelch mode; only signals from your radio system can unsquelch the receiver.

2. TRANSMISSION

Step 1. Select the desired radio channel.

Step 2. Remove the microphone or handset from its hang-up box. Monitor the channel for activity.

Step 3. If the radio channel is not in use, hold down the PTT button on the microphone or handset handle and speak slowly and distinctly into the microphone.

3. MONITOR SWITCH (PL OR DPL)

To place the radio in the monitor (carrier squelch) mode while the microphone or handset is still on-hook, press the locking MONITOR switch pushbutton to the in position. To restore coded squelch operation, press this button a second time returning it to the out position.

NOTE

If control head is not equipped with a MONITOR switch, a slide switch on the hang-up box will provide this same function.

4. BUSY LIGHT (OPTIONAL)

If your radio is equipped with the optional busy light, this feature will eliminate the need to continually recheck a busy channel to determine when it becomes idle. Any time there is traffic on the selected channel the busy light will flash; if the channel is available the lamp will be out.



MOTOROLA

MITREK PLUS™

Two-Way FM Radio

Options B432 and B486

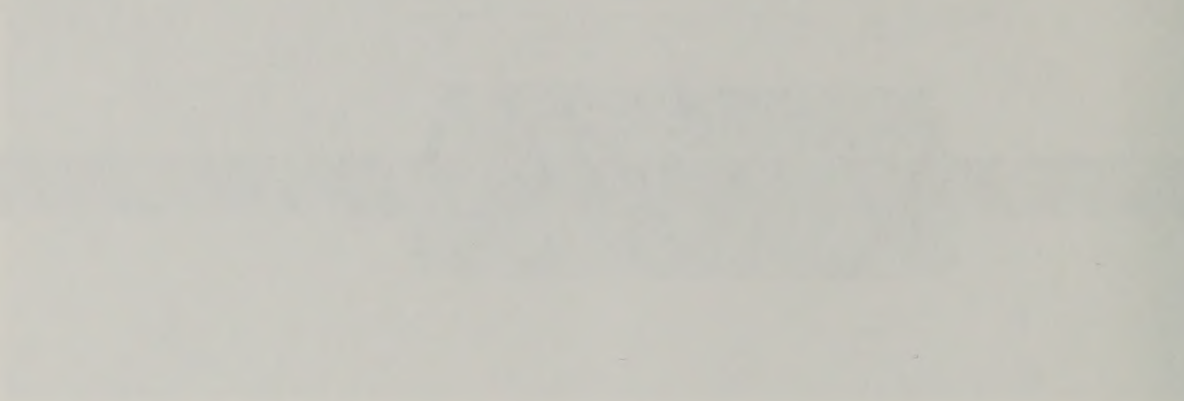
SUPPLEMENT to Instruction Manual

**68P81045E65
68P81045E70
68P81045E75**

**Low Band
High Band
UHF Band**

MOTOREK PLUS
Two-Way FM Radio
20 Watt 12.5 VDC

MOTOROLA



Model 1000

1. The radio is designed for use in the 12.5 VDC power supply system. It is not recommended for use in other power supply systems.

2. The radio is designed for use in the 12.5 VDC power supply system. It is not recommended for use in other power supply systems.

3. The radio is designed for use in the 12.5 VDC power supply system. It is not recommended for use in other power supply systems.

4. The radio is designed for use in the 12.5 VDC power supply system. It is not recommended for use in other power supply systems.

5. The radio is designed for use in the 12.5 VDC power supply system. It is not recommended for use in other power supply systems.

6. The radio is designed for use in the 12.5 VDC power supply system. It is not recommended for use in other power supply systems.

SUPPLEMENT to Instruction Manual

Low Band	888104525
High Band	888104525
UHF Band	888104525



MOTOROLA INC.

**Communications
Group**

MITREK PLUSTM

OPTIONS B432
AND B486

1. DESCRIPTION

1.1 The **MITREK PLUS** radio is a mobile radio intended for use in critical applications. It is similar to the basic **MITREK** radio with enhanced specifications in three categories, (1) reduced transmitter distortion, (2) increased receiver selectivity, (3) increased audio power output with reduced distortion. This supplement defines the specific differences between **MITREK PLUS** and the basic **MITREK** radio. For all other specific details not covered in this supplement, refer to the manual for the basic **MITREK** radio of the applicable band;

Low Band	68P81045E65
High Band	68P81045E70
UHF Band	68P81045E75

1.2 Section 2 of this supplement gives the model structure differences for the **MITREK PLUS** radios. First, it gives the new models applicable to all bands, then the model differences for each band, and finally the models established for options used with the **MITREK PLUS** radios. Section 3 gives the specific differences between the **MITREK PLUS** units and the comparable units described in the **MITREK** manual. Section 4 highlights the few differences in installation procedures and section 5 gives the single difference in alignment required for the **MITREK PLUS** radio.

1.3 The specifications for the **MITREK PLUS** radios are the same as those shown for the standard **MITREK** radios except as shown in Table 1.

Table 1. MITREK PLUS Specifications

	B432	B486
Transmitter Distortion	2%	2%
Receiver Selectivity		
Low Band	100 dB (20 kHz)	100 dB (20 kHz)
High Band	100 dB (30 kHz)	100 dB (30 kHz)
UHF Band	90 dB (25 kHz)	90 dB (25 kHz)
Audio Power	12 watts	10 watts
Receiver Distortion	3%	3%

1.4 Option B486 is a special purpose radio. All **MITREK PLUS** changes are made to the radio for B486 but it uses the conventional **MITREK** cable kits shown in the **MITREK** manual. A new speaker kit (HSN4009A with radio; HSN4010A with Systems 90) is

used but this high power speaker uses a two-wire cable and connects in the same manner as the conventional **MITREK** speaker.

2. MODEL COMPLEMENT

2.1 ALL BANDS

The following models are applicable to all **MITREK PLUS** models.

Table 2. Changes Applicable to All Bands

Model	Description	Replaces
HSN4007A	Speaker (B432)	HSN4000A
HSN4009A	Speaker (B486)	HSN4000A
HKN4060A	Cable, Low Power, 4-Freq.	HKN4000 A/1A
HKN4056A	Cable, High Power, 4-Freq.	HKN4016A/7A

2.2 UHF BAND

The following models are used on **MITREK PLUS** models in the UHF band.

Table 3. Changes Applicable to UHF Models

Model	Description	Replaces
HUE1073B	Chassis, 30 W, 403-420 MHz	HUE1001B
HLE4121B	Main Board, 403-420 MHz	HLE4001C
HLN4192A	Interconnect Board	HLN4044A
HLN4195B	Hardware Kit	HLN4015B
HUE1074B	Chassis, 30 W, 450-512 MHz	HUE1002B
HLE4122B	Main Board, 450-512 MHz	HLE4002C
HLN4192A	Interconnect Board	HLN4044A
HLN4195B	Hardware Kit	HLN4015B
HUE1083B	Chassis, 50 W, 403-420 MHz	HUE1011B
HLE4121B	Main Board, 403-420 MHz	HLE4001C
HLN4192A	Interconnect Board	HLN4044A
HLN4195B	Hardware Kit	HLN4015B
HUE1084B	Chassis, 50 W, 450-512 MHz	HUE1012B
HLE4122B	Main Board, 450-512 MHz	HLE4012C
HLN4192A	Interconnect Board	HLN4044A
HLN4195B	Hardware Kit	HLN4015B
HUE1116B	Chassis, 75/100 W, 403-420 MHz	HUE1031B
HLE4121B	Main Board, 403-420 MHz	HLE4001C
HLN4192A	Interconnect Board	HLN4044A
HLN4198B	Hardware Kit	HLN4036B
HUE1094B	Chassis, 75/100 W, 450-512 MHz	HUE1032B
HLE4122B	Main Board, 450-512 MHz	HLE4002C
HLN4192A	Interconnect Board	HLN4044A
HLN4198B	Hardware Kit	HLN4036B

2.3 HIGH BAND

The following models are used on **MITREK PLUS** models in high band.

Table 4. Changes Applicable to High Band Models

Model	Description	Replaces
HUD1053B	Chassis, 40 W, 136-146 MHz	HUD1001B
HLD4081B	Main Board, 136-146 MHz	HLD4001C
HLN4192A	Interconnect Board	HLN4044A
HLN4194A	Hardware Kit	HLN4014A
HUD1054B	Chassis, 40 W, 146-174 MHz	HUD1002B
HLD4082B	Main Board, 146-174 MHz	HLD4002B
HLN4192A	Interconnect Board	HLN4044A
HLN4194A	Hardware Kit	HLN4014A
HUD1063B	Chassis, 60 W, 136-146 MHz	HUD1011B
HLD4081B	Main Board, 136-146 MHz	HLD4001C
HLN4192A	Interconnect Board	HLN4044A
HLN4194A	Hardware Kit	HLN4014A
HUD1064B	Chassis, 60 W, 146-174 MHz	HUD1012B
HLD4082B	Main Board, 146-174 MHz	HLD4002B
HLN4192A	Interconnect Board	HLN4044A
HLN4194A	Hardware Kit	HLN4014A
HUD1074B	Chassis, 75/110 W, 146-174 MHz	HUD1032B
HLD4082B	Main Board, 146-174 MHz	HLD4002B
HLN4192A	Interconnect Board	HLN4044A
HLN4199A	Hardware Kit	HLN4037A
HUD1082B	Chassis, 75/110 W, 136-146 MHz	
HLD4081B	Main Board, 136-146 MHz	HLD4001C
HLN4192A	Interconnect Board	HLN4044A
HLN4199A	Hardware Kit	HLN4037A

2.4 LOW BAND

The following models are used on **MITREK PLUS** models in low band.

Table 5. Changes Applicable to Low Band Models

Model	Description	Replaces
HUB1043B	Chassis, 60 W, 29.7-39 MHz, Non-Extender	HUB1001B
HLN4192A	Interconnect Board	HLN4044A
HLN4193A	Hardware Kit	HLN4013A
HUB1044B	Chassis, 60 W, 39-50 MHz, Non-Extender	HUB1002B
HLN4192A	Interconnect Board	HLN4044A
HLN4193A	Hardware Kit	HLN4013A
HUB1053B	Chassis, 110 W, 29.7-39 MHz, Non-Extender	HUB1011B
HLN4192A	Interconnect Board	HLN4044A
HLN4193A	Hardware Kit	HLN4039A
HUB1054B	Chassis, 110 W, 39-50 MHz, Non-Extender	HUB1012B
HLN4192A	Interconnect Board	HLN4044A
HLN4193A	Hardware Kit	HLN4039A
HUB1063B	Chassis, 60 W, 29.7-39 MHz, Extender	HUB1021B
HLN4192A	Interconnect Board	HLN4044A
HLN4193A	Hardware Kit	HLN4013A
HUB1064B	Chassis, 60 W, 39-50 MHz, Extender	HUB1022B
HLN4192A	Interconnect Board	HLN4044A
HLN4193A	Hardware Kit	HLN4013A
HUB1073B	Chassis, 110 W, 29.7-39 MHz, Extender	HUB1031B
HLN4192A	Interconnect Board	HLN4044A
HLN4200A	Hardware Kit	HLN4039A
HUB1074B	Chassis, 110 W, 39-50 MHz, Extender	HUB1032B
HLN4192A	Interconnect Board	HLN4044A
HLN4200A	Hardware Kit	HLN4039A

2.5 OPTIONS

The following models were established to replace comparable models in the various **MITREK** option kits when used with the **MITREK PLUS** radios.

Table 6. Models Used with Options

Model	Description	Replaces
HSN4008A	Speaker, Systems 90, for B432	HSN4002A
HSN4010A	Speaker, Systems 90, for B486	HSN4002A
HKN4055A	Cable Kit, High Power, Positive Ground, 4-Freq., Control Head	HSN4022A
HKN4057A	Cable Kit, Low Power, Positive Ground, 4-Freq., Systems 90	HSN4009A
HKN4058A	Cable Kit, Low Power, Negative Ground, 4-Freq., Systems 90	HSN4008A
HKN4059A	Cable Kit, Low Power, Positive Ground, 4-Freq., Control Head	HSN4006A
HKN4061A	Cable Kit, High Power, Positive Ground, 4-Freq., Systems 90	HSN4024A
HKN4062A	Cable Kit, High Power, Negative Ground, 4-Freq., Systems 90	HSN4023A

3. SPECIFIC CHANGES

3.1 UHF RADIOS

3.1.1 The following parts shown in Table 7 have been added to the conventional UHF main boards to form the UHF main boards used with **MITREK PLUS** radios.

3.1.2 Part values are changed from the values used in the conventional UHF main boards to form the UHF main boards used in **MITREK PLUS**. The changed values are shown in Table 8.

3.1.3 In addition to the above changes, a new Interconnect Board HLN4192A is used with **MITREK PLUS**. This board is the same as the HLN4044A Interconnect Board except that C1 and C2 are changed to 1000 uF capacitors (Motorola Part No. 23-83210A24 or 23-80167C01).

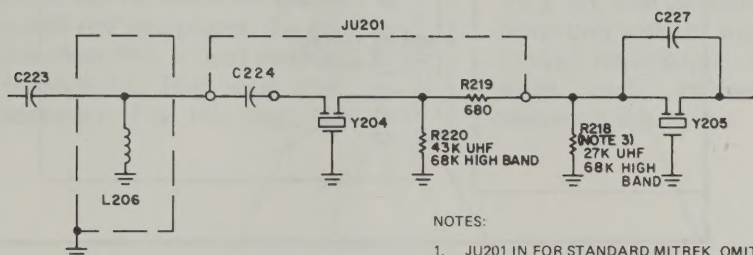
3.2 HIGH BAND RADIOS

3.2.1 The following parts shown in Table 9 have been added to the high band main boards to form the high band main boards used with **MITREK PLUS** radios.

3.2.2 The following part values are changed from the values used in the high band main boards for the high band main boards used in **MITREK PLUS**.

Table 7. Added Parts for MITREK PLUS UHF Main Boards

Reference Designation	Added		Motorola Part No.	Description
	From	To		
R219	See Figure 1		6-124A45	680 ohm $\pm 5\%$
R220	See Figure 1		6-124A88	43k $\pm 5\%$
Y204	See Figure 1		48-84396K02	Coupled Resonator; 10.7 MHz



BEPS-29317-8

NOTES:

1. JU201 IN FOR STANDARD MITREK, OMITTED FOR MITREK PLUS.
2. C224, Y204, R219, R220, IN FOR MITREK PLUS, OMITTED FOR STANDARD MITREK.
3. R218 IS 18K IN STANDARD MITREK.

Figure 1. Simplified Schematic Diagram for Added I-F Filter for UHF and High Band MITREK PLUS Radios

Table 8. Values Changed for MITREK PLUS UHF Main Boards

Reference Designation	Motorola Part No.	Description
R218	6-124A83	27k $\pm 5\%$
U401	51-80274B01	type M7401
U402	51-80274B01	type M7401

Table 9. Added Parts for MITREK PLUS High Band Main Boards

Reference Designation	Added		Motorola Part No.	Description
	From	To		
R219	See Figure 1		6-124A45	680 ohm $\pm 5\%$
R220	See Figure 1		6-124A83	27k $\pm 5\%$
Y204	See Figure 1		48-84396K02	Coupled Resonator; 10.7 MHz

Table 10. Values Changed for MITREK PLUS High Band Main Boards

Reference Designation	Motorola Part No.	Description
C227	21-82450B20	0.68 pF
R218	6-124A93	68k $\pm 5\%$
U401	51-80274B01	type M7401
U402	51-80274B01	type M7401
C208	21-84493B27	51 pF
C210	21-83406D68	24 pF
C213	21-82450B20	0.68 pF
C214	21-84493B31	57 pF, NP0
C215	21-84494B03	80 pF, NP0
C222	21-82610C71	90 pF, NP0
C223	21-84494B03	80 pF, NP0
C224	21-83406D56	24 pF
R207	6-124A93	68k $\pm 5\%$
R209	6-124A93	68k $\pm 5\%$

3.2.3 In addition to the above changes, a new Interconnect Board HLN4192A is used with MITREK PLUS. This board is the same as the HLN4044A Interconnect Board except that C1 and C2 are changed to 1000 uF capacitors (Motorola Part No. 23-83210A24 or 23-80167C01).

3.3 LOW BAND

3.3.1 The following part values shown in Table 11 are changed from the values used in the conventional low band MITREK main boards to form the low band main boards used in MITREK PLUS.

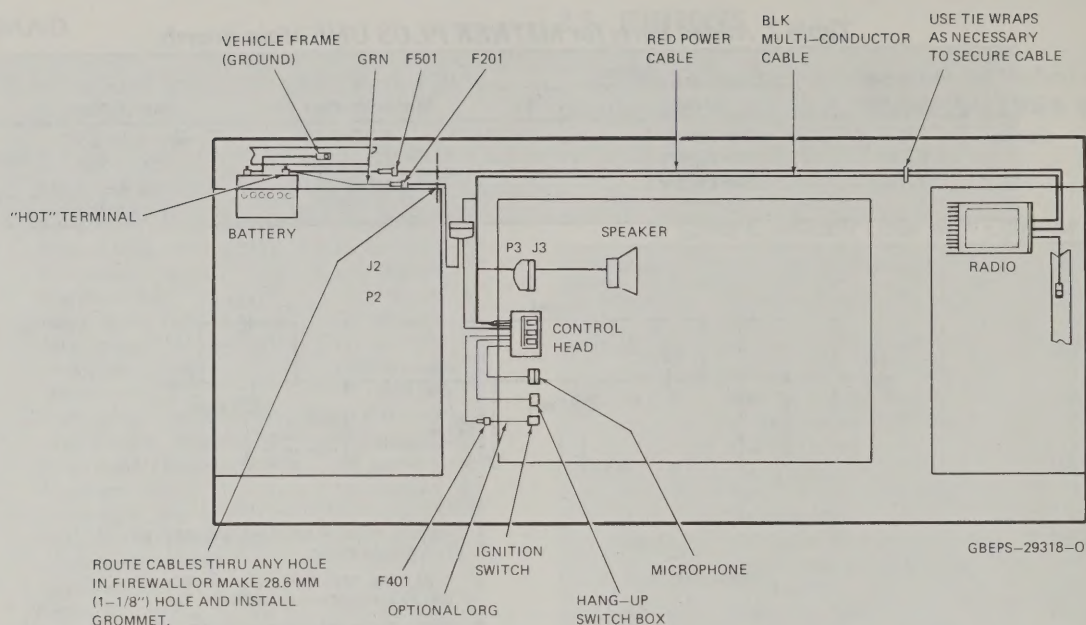


Figure 2. Power Connection Installation Details

Table 11. Values Changed for **MITREK PLUS** Low Band Main Boards

Reference Designation	Motorola Part No.	Description
U401	51-80274B01	type M7401
U402	51-80274B01	type M7401

3.3.2 In addition to the above changes, a new Interconnect Board HLN4192A is used with **MITREK PLUS**. This board is the same as the HLN4044A Interconnect Board except that C1 and C2 are changed to 1000 uF capacitors (Motorola Part No. 23-83210A24 or 23-80167C01).

3.4 RADIO CABLES

A new set of cables have been established to connect the **MITREK PLUS** radio to the control head or the **SYSTEMS 90** Alternate Control Module. Cable connection details are given in instruction section 68P81044E34 located at the end of this section. **SYSTEMS 90** information appears in instruction section 68P81110E50.

3.5 SPEAKERS

New speakers have been established for use with the **MITREK PLUS** radios; the HSN4007A (B432) or HSN4009A (B486) Speaker is used with the standard control head and the HSN4008A (B432) or HSN4010A (B486) is used with the **SYSTEMS 90** options. Interconnect information for the speakers is shown in the radio cable instruction section 68P81044E34. **SYSTEMS 90** information appears in instruction section 68P81110E50.

CAUTION

Be careful not to connect a **MITREK PLUS** radio to standard **MITREK** speakers that are not capable of handling the high power of **MITREK PLUS**. Only speakers capable of handling 30 watts, with an impedance of 3.2 ohms, should be connected to **MITREK PLUS** or to the **MITREK PLUS SYSTEMS 90** public address option.

3.6 HANDSET HANGUP BOX

The **MITREK PLUS** radio uses either a Model HLN4196A or HLN4197A Handset Hangup Box for the Model TMN6057A Handset. For proper application, see Note 8 in the Radio Cable section, 68P81040E34. The HLN4196A and HLN4197A are the same as the standard **MITREK** handset hangup boxes, except they both use a different cable assembly (Motorola part number 1-80705T18) instead of those indicated in the standard **MITREK** instruction manual.

4. INSTALLATION

4.1 The **MITREK PLUS** radio is installed in the same manner as the standard **MITREK** radio described in the instruction manual except for cable installation and speaker installation. Use Figure 2 in place of the power connection detail on the **MITREK** installation sheet. If routing of cables is impossible due to the Molex connectors J2 and P3, the pins can be removed from these connectors using a ST-946 Extraction Tool available from the National Parts department.

4.2 When installing the speaker, use Figure 2 in place of Detail B of the Control Head, Speaker, and Accessories section of the standard **MITREK** Installation Procedure sheet 68P81109E32.

5. ALIGNMENT

The alignment procedure for **MITREK PLUS** radios is the same as that for the conventional **MITREK** radios except that less than 3% receiver audio distortion cannot be guaranteed using this test equipment. To improve audio distortion to less than 3%, a final receiver oscillator warp step (UHF-Step 15; High and Low bands-Step 13) may be necessary. For this step, an

HP331A Distortion Analyzer (or similar equipment with floating input terminals) is connected across the speaker. Proceed as follows:

For each frequency, set the rf signal generator to the carrier frequency (± 30 Hz for low band or ± 100 Hz for high band or UHF) and adjust signal level for 1 mV into the radio. While measuring distortion with the signal generator set for 1 kHz modulation ± 3 kHz deviation, warp each receiver oscillator for minimum distortion.

POSITION SPEAKER IN TRUNNION BRACKET AND ROTATE TO VERTICAL POSITION WITH MOTOROLA LOGO AT BOTTOM BEFORE TIGHTENING SCREWS.

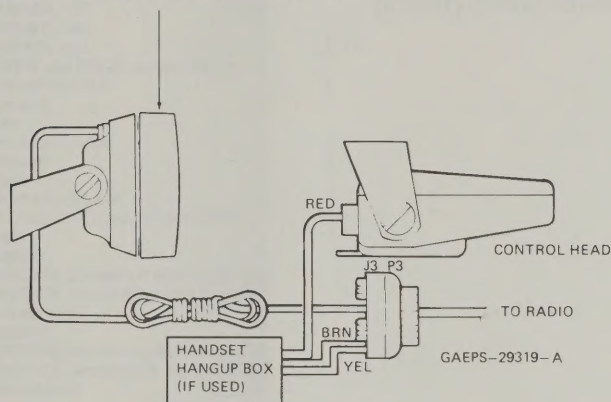


Figure 3. Control Head Connection Detail

parts list

	Power
High	Low
HKN4055A	HKN4059A Positive Ground, Control Head
HKN4056A	HKN4060A Negative Ground, Control Head
HKN4061A	HKN4057A Positive Ground, Systems 90
HKN4062A	HKN4058A Negative Ground, Systems 90

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F201	65-86099	fuse: 7.5A; 32 V
F501	65-61682	25A; 32 V (HKN4057A-4060A)
J2	—	connector, receptacle: consists of: 5-pin PIN, female; 5 used
J3	—	consists of: 15-pin PIN, female; 15 used
P1	—	connector, plug: consists of: CONNECTOR, female; 19-contact HOUSING, connector; left half HOUSING, connector; right half NUT, hex: 4-40 x 3/32"; 2 used SCREW, machine: 4-40 x 1-1/8"; 2 used
	9-801050	SCREW, tapping: 6-20 x 3/4"; 2 used
	15-82075D04	WASHER, "C"
	15-82075D05	WASHER, flat
	2-7019	WASHER, flat
	3-135198	SCREW and KNOB, assembly
	3-132127	CLIP, strain relief
	or 3-140049	
	4-11722	
	4-800671	
	4-82113D01	
	1-80701T52	
	42-80168A01	
P2	—	consists of: 5-pin PIN, male; 5 used
P3	—	consists of: 15-pin PIN, male; 15 used
P101	28-80009C02	PIN, terminal; 15 used (control head models)
	29-82335A01	
or P101	29-82602P01	consists of: HOUSING, connector; BLK, 22-position CONTACT, receptacle; 20 used (Systems 90 models)
	14-84556B01	
	9-84151B03	
P102	—	consists of: HOUSING, connector; BLU, 6-position CONTACT, receptacle; 5 used (Systems 90 models)
	14-84590B02	
	9-84151B03	
W1	—	wire assembly: CABLE, multi-conductor includes ref P3 and: CABLE, 27-conductor; 17' (HKN4055A-4062A) SLEEVING; GRN, 1-1/2" SLEEVING; GRN, 1" (low power only)
	30-84875E01	LEAD and FUSE ASSEMBLY (C)
	37-82378B12	includes ref. item F201, J2, and: CABLE, battery; GRN, #14 ga. str. SLEEVING, coded no. 4 TERMINAL, pin; 2 used SLEEVING, coded no. 19 LUG, solder LUG, ring tongue LUG, ring tongue INSULATOR, fuseholder cap INSULATOR, fuseholder body CLIP, fuse; 2 used SPRING, fuse compression
W2	—	CABLE; includes ref item F501, W5 and HKN4057A-4060A) and: INSULATOR, fuseholder cap INSULATOR, fuseholder body CLIP, fuse; 2 used SPRING, fuse compression LUG, ring tongue CABLE, battery; RED; 20' (HKN4055A-4060A) CABLE, battery; BLK; 20' (HKN4055A-4060A) CABLE, battery; RED; 18' (HKN4055A-4062A) CABLE, battery BLK; 18' (HKN4055A-4062A) LEAD, ground consists of: CABLE, battery BLK; 5-1/2' (HKN4055A-4060A) CABLE, battery BLK; 5-1/2' (HKN4055A-4062A) CABLE, battery RED; 5-1/2' (HKN4055A-4059A) CABLE, battery; RED; 5-1/2' (HKN4055A-4061A) LUG, ring tongue (HKN4055A, 4059A, 4061A, 4062A) LUG, ring tongue (HKN4057A-4061A)
	37-00061347	
	30-10310D07	
	37-82603D04	
	29-82602D01	
	37-82603D19	
	29-136968	
	or 29-82607B03	
	or 29-832914	
	14-82883A01	
	14-82882A01	
	42-82884A01	
	41-82885A01	
W3	—	
	14-82883A01	
	14-82882A01	
	42-82884A01	
	41-82885H01	
	29-84528B02	
	30-858553	
	or 30-858552	
	30-812505	
	or 30-851875	
W4	—	
	30-858552	
	or 30-851875	
	or 30-858553	
	or 30-812505	
	29-84528B05	
	or 29-84528B02	

MITREK PLUS™ RADIO CABLES

MODELS HKN4055-62A

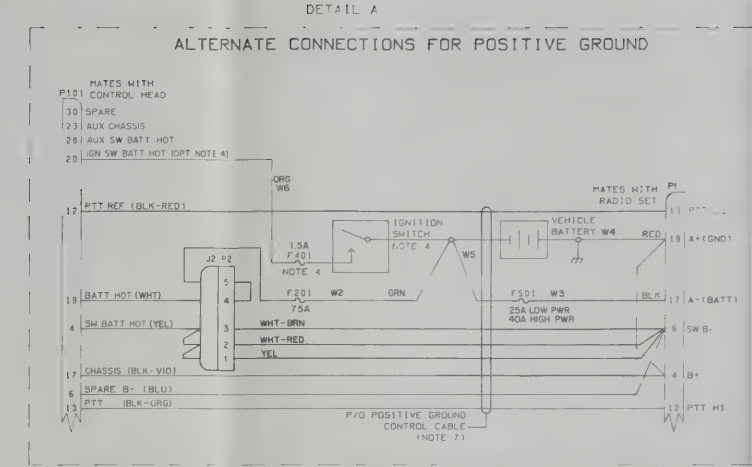
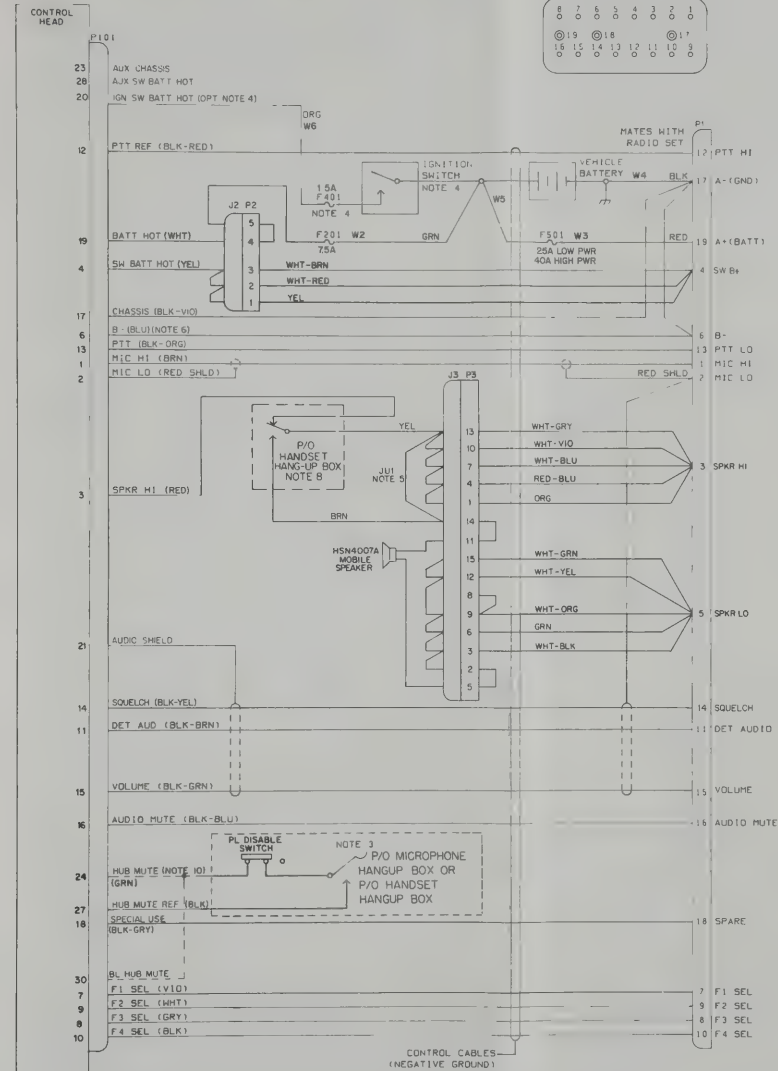
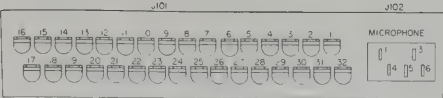
FUNCTION

The radio cable interconnects the control head or the Systems 90 Alternate Control Module and the mobile speaker to the **MITREK PLUS** radio. It includes the primary power connections.

parts list

Power		REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
High	Low			
HKN4055A	HKN4059A			Positive Ground, Control Head
HKN4056A	HKN4060A			Negative Ground, Control Head
HKN4057A	HKN4057A			Positive Ground, Systems 90
HKN4062A	HKN4058A			Negative Ground, Systems 90
				PL-6775-A
F201	65-86099			fuse: 7.5A; 32 V
F501	65-61682			25A; 32 V (HKN4057A-4060A)
J2	—			connector, receptacle: consists of: 5-pin PIN, female; 5 used
J3	9-80008C01 29-82336A01			consists of: 15-pin PIN, female; 15 used
P1	—			connector, plug: consists of: CONNECTOR, female; 19-contact HOUSING, connector; left half HOUSING, connector; right half NUT, hex 4-40 x 3/32"; 2 used SCREW, machine; 4-40 x 1-1/8"; 2 used
	9-901050 15-82075D04 15-82075D05 2-7019 3-135198 3-132127 or 3-140049 4-11722 4-800671 4-82113D01 1-80701T52 42-80168A01			SCREW, tapping; 6-20 x 3/4"; 2 used WASHER, "C" WASHER, flat WASHER, flat SCREW and KNOB, assembly CLIP, strain relief
P2	—			consists of: 5-pin PIN, male; 5 used
P3	28-80009C01 29-82335A01			consists of: 15-pin PIN, male; 15 used PIN, terminal; 15 used (control head models)
P101	—			consists of: HOUSING, connector; BLK, 22-position CONTACT, receptacle; 20 used (Systems 90 models)
or P101	14-84556801 9-84151B03			consists of: HOUSING, connector; BLU, 6-position CONTACT, receptacle; 5 used (Systems 90 models)
P102	—			consists of: HOUSING, connector; BLU, 6-position CONTACT, receptacle; 5 used (Systems 90 models)
	14-84590802 9-84151B03			
W1	—			wire assembly: CABLE, multi-conductor includes ref item P3 and: CABLE, 27-conductor; 17" (HKN4055A-4062A)
	30-84875E01			SLEEVEING, GRV, 1-1/2"
	37-82378B12			SLEEVEING, GRV, 1" (low power only)
W2	37-00061347			LEAD and FUSE ASSEMBLY (GRN) includes ref item F201, J2, and: CABLE, battery; GRN, #14 ga. str. SLEEVEING, coded no. 4 TERMINAL, pin; 2 used SLEEVEING, coded no. 19 LUG, solder LUG, ring tongue LUG, ring tongue INSULATOR, fuseholder cap INSULATOR, fuseholder body CLIP, fuse; 2 used SPRING, fuse compression
	30-10310D07 37-82603D04 29-82602D01 37-82603D19 29-136968 or 29-82607B03 or 29-832914 14-82883A01 14-82882A01 42-82884A01 41-82885A01			CABLE, includes ref item F501, W5 (on HKN4057A-4060A) and: INSULATOR, fuseholder cap INSULATOR, fuseholder body CLIP, fuse; 2 used SPRING, fuse compression LUG, ring tongue CABLE, battery; RED; 20' (HKN4058A, 4060A) CABLE, battery; BLK; 20' (HKN4057A, 4059A) CABLE, battery; RED; 18' (HKN4056A, 4062A) CABLE, battery BLK, 18' (HKN4055A, 4061A)
W3	14-82883A01 14-82882A01 42-82884A01 41-82885H01 29-84528B02 30-858553			LEAD, ground consists of: CABLE, battery BLK; 5-1/2' (HKN4058A, 4060A) CABLE, battery BLK; 5-1/2' (HKN4056A, 4062A) CABLE, battery RED; 5-1/2' (HKN4057A, 4059A) CABLE, battery; RED; 5-1/2' (HKN4055A, 4061A) LUG, ring tongue (HKN4055A, 4056A, 4061A, 4062A) LUG, ring tongue (HKN4057A-4061A)
	or 30-858552 30-812505 or 30-851875			
W4	30-858552			
	or 30-851875 or 30-858553 or 30-812505 29-84528B05 or 29-84528B02			

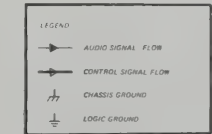
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F501	65-61683	FUSE, 40A; 32 V
W5	30-812505	LEAD, fused; consists of: CABLE, battery; RED; 2-1/2' (used on HKN4056A, 4062A) CABLE, battery; BLK; 2-1/2' (used on HKN4055A, 4061A)
	or 30-851875	LUG, ring tongue RECEPTACLE, fuse SCREW, tapping RETAINER, fuse CAP, protection
W5	29-84528B05 9-84277B01 3-400465 42-84275B01 38-84383D01	Part of W3 for low power radios (HKN4057A-4060A) HKN4041A for high power negative ground (used with HKN4056A, 4062A) HKN4040A for high power positive ground (used with HKN4055A, 4061A) p/o ignition sense lead option. See Accessories section 68P81039E26 in the Servicing manual.
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
W6	—	



NOTES:

- Unless otherwise specified:
Resistor values are in ohms.
Capacitor values are in microfarads.
- S103 is normally used for PL monitor. However, it may be used as a spare switch for special purpose. In this case JU104 is installed to complete audio mute path to hangup box.
- Mic hangup box used for PU/DPL radios:
Hangup box shown off-hook. If S103 is omitted or used for special purpose, a HLN4025A Hangup Box is used. This hangup box includes a slide switch for PL monitor.
- Orange ignition switch wire is optional. When this option is installed, transmitter use requires ignition switch to be on; radio may be used in receive only mode with ignition switch off. JU101 must be omitted.
- JU1 (J3-11 to J3-13) omitted when handset hangup box is used.
- Omitted.
- Detail A shows connection differences for positive ground cables. All other connections are identical to those shown for negative ground control cables at left.
- The HLN4197A Handset Hang-Up Box is normally used in handset applications (hookswitch shown in off-hook position). An HLN4196A Handset Hang-Up Box is used when S103 on the control head is not used for MONITOR.
- Omitted.
- When optional busy light circuit is used, hangup box mute lead (grn) is connected to pin 30 instead of pin 24.

Control Cable Model Chart				
Model	Length (Feet)	No. of Channels (Note 6)	Ground Polarity (Note 7)	Power Type
HKN4055A	17	4	+	High Cont. Head
HKN4056A	17	4	-	High Cont. Head
HKN4057A	17	4	+	Low Sys. 90
HKN4058A	17	4	-	Low Sys. 90
HKN4059A	17	4	+	Low Cont. Head
HKN4060A	17	4	-	Low Cont. Head
HKN4061A	17	4	+	High Sys. 90
HKN4062A	17	4	-	High Sys. 90



MITREK PLUS™ RADIO CABLES

MODELS HKN4055-62A

FUNCTION

The radio cable interconnects the control head or the Systems 90 Alternate Control Module and the mobile speaker to the MITREK PLUS radio. It includes the primary power connections.

68P81044E34-B
2-13-84 GGI

MITREK PLUS RADIO CABLES

MITREK PLUS™
Two-Way FM Radio
Options B432 and B486

68P81046E05-B



MOTOROLA INC.

**Communications
Group**

instruction manual revision

Supersedes WMR-0048

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct the manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E65-O	<i>Mitrek Two-Way FM Radio, 29.7 – 50 MHz</i>
68P81045E70-O	<i>Mitrek Two-Way FM Radio, 136 – 174 MHz</i>
68P81045E75-A	<i>Mitrek Two-Way FM Radio, 406 – 420 MHz and 450 - 512 MHz</i>

REVISION DETAILS:

In your manual, add the attached Instruction Section 68P81039E24-F (Sheet 1 of 2 and Sheet 2 of 2), and delete Instruction Section 68P81039E24-C/E (Sheet 1 of 2 and Sheet 2 of 2).

1 of 1

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WMR-0100
3-1-84 GGI

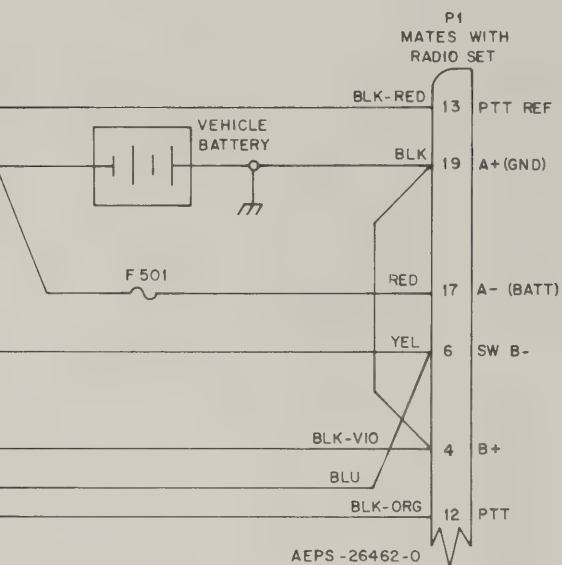
HKN4000A, HKN4016A
HKN4001A, HKN4017A
HKN4002A, HKN4018A
HKN4003A, HKN4019A
HKN4004A, HKN4020A
HKN4005A, HKN4021A
HKN4006A, HKN4022A

HK N4016-22A

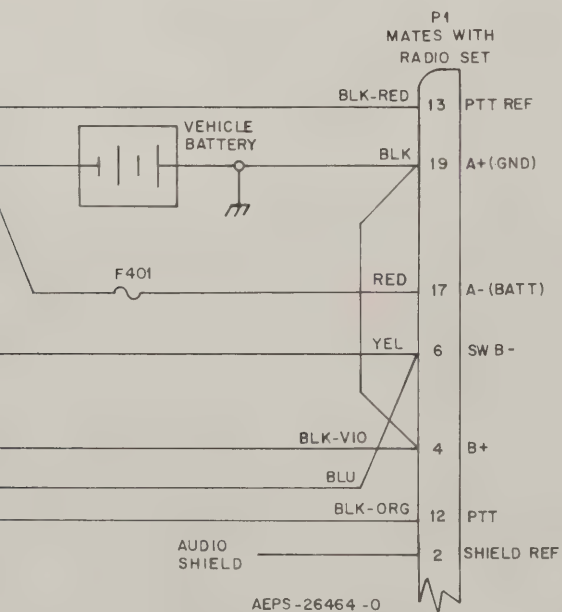


The control head provides control of the trunk-mounted radio from the vehicle passenger compartment. It controls frequency selection, volume, and squelch. A PL MONITOR switch is provided for "Private-Line" radios. The radio cable interconnects the control head and radio and includes primary power connections.

POSITIVE GROUND MITREK CABLE MODIFIED POSITIVE GROUND INSTALLATION



POSITIVE GROUND MOCOM•70 CABLE MODIFIED FOR POSITIVE GROUND MITREK IN- STALLATION





MOTOROLA INC.

**Communications
Group**

instruction manual revision

Supersedes WMR-0091

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct the manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P80100W30-O	<i>Motrek Two-Way FM Radio; 150.8 – 162 MHz; 35/55/100 Watts</i>
68P80100W35-O	<i>Motrek Two-Way FM Radio; 450 – 470 MHz; 30/45/90 Watts</i>
68P81045E65-O	<i>Mitrek Two-Way FM Radio; 29.7 – 50 MHz, 60/110 Watts</i>
68P81045E70-O	<i>Mitrek Two-Way FM Radio; 136 – 174 MHz, 40/60/75/110 Watts</i>
68P81045E75-A	<i>Mitrek Two-Way FM Radio; 406 – 420 MHz and 450 – 412 MHz, 30/50 Watts, 75/100 Watts</i>
68P81045E80-O	<i>Mitrek Two-Way FM Radio; 806 – 816 MHz Transmit, 851 – 861 MHz Receive, 12/35 Watts</i>
68P81046E05-B	<i>Mitrek Plus Two-Way FM Radio, Options B432 and B486</i>

REVISION DETAILS:

1. In Instruction Manual **68P80100W30-O**:

- A. Page iv, Model Chart EPW-0045-O, change "HLN4044A" to "HLN4044B."
- B. Instruction Section **68P80100W06-O** (Sheet 3 of 5), substitute Parts List PL-6030-F, attached, for Parts List PL-6030-E.
- C. Instruction Section **68P80100W06-O** (Sheet 4 of 5), Diagram EEPW-0085-O, the interconnect board section, change the title "HLN4044A INTERCONNECT BOARD" to "HLN4044A,B INTERCONNECT BOARDS."

2. In Instruction Manual **68P80100W35-O**:

- A. Page iv, Model Chart EPW-0049-O, change "HLN4044A" to "HLN4044B."
- B. Instruction Section **68P80100W04-O** (Sheet 3 of 5), substitute Parts List PL-6030-F, attached, for Parts List PL-6030-E.

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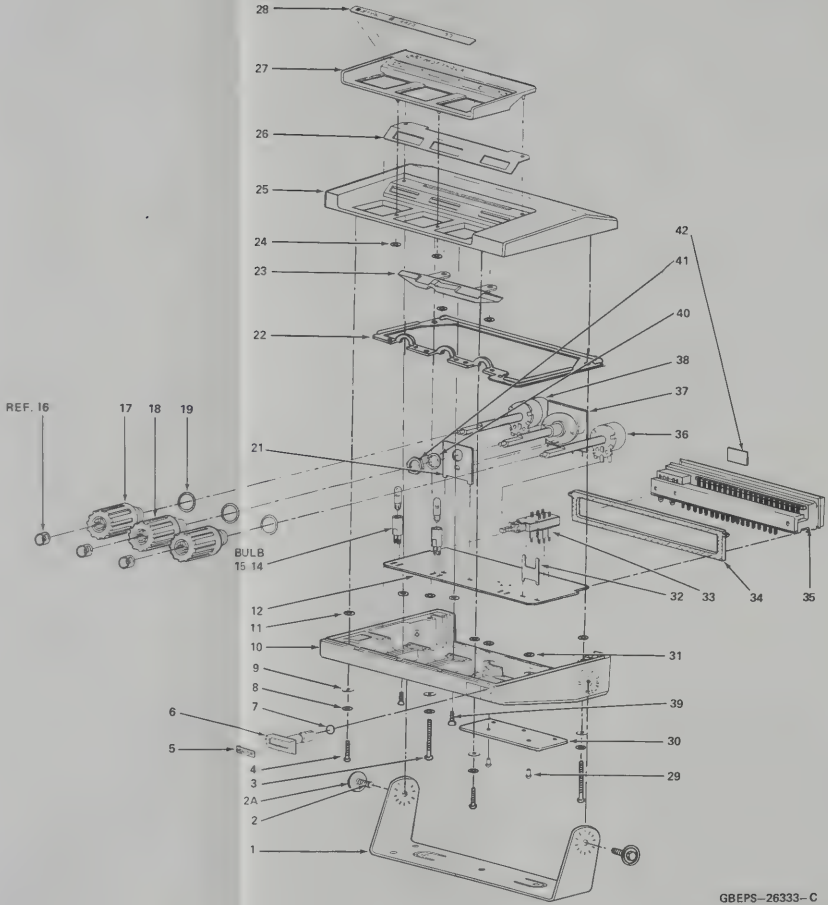
WMR-0095
12-13-83 GGI

“MITREK” CONTROL HEAD
MECHANICAL PARTS

parts list

Control Head Mechanical Parts List PL-6088 E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	2-000000-0	runion bracket
2A	4-135784	washer for runion, 2 used
3	3-10903882	machine screw for rear housing, (M3.5 x 0.6 x 30), 2 used
4	3-10903858	machine screw for front housing, (M3.5 x 0.6 x 13), 2 used
5	33-80117A01	monitor nameplate (decals)
6	56-80102A01	pushbutton (PL models only)
7	or 36-80102A02	pushbutton (CS models only)
8	42-10128A22	O-ring (weather-resistant models only)
9	4-7959	lockwasher for housing screws, 4 used
10	4-119390	flat washer for housing screws, 4 used
11	13-80109A01	bottom housing
12	4-80148A01	caprive washer for housing screws, 6 used
13	84-80112A01	printed circuit board
14	9-80051801	light socket without busy light option, 2 used
15	65-83376K01	light bulb without busy light option, 2 used
16	42-10062A14	with busy light option, 3 used
17	26-80107A01	knob retainer (installed by vendor), 3 used
18	36-80107A02	volume squinch knob
19	42-10128A23	O-ring (weather-resistant models only), 2 used for single-frequency
20	32-80208A01	gasket to isolate light
21	7-80158A01	frequency switch bracket
22	32-80208B01	housing gasket
23	81-80118A01	lens
24	42-10113A31	retainer ring for bezel and lens, 6 used
25	15-80108A01	top housing
26	32-80140B01	adhesive strip for bezel (non-weather-resistant models only)
27	13-80180A01	weather-resistant models: bezel (multiple-frequency)
or 13-80180A02		weather-resistant models: bezel (single-frequency)
or 13-80114A01		weather-resistant models: bezel (multiple-frequency)
or 13-80114A02		non-weather-resistant models: bezel (single-frequency)
28	33-80116A02	non-weather-resistant models: overlay nameplate for bezel (one-frequency models without busy light option)
or 33-80116A01		overlay nameplate for bezel (four-frequency models without busy light option)
or 33-80116A05		overlay nameplate for bezel (four-frequency models with busy light option)
or 33-80116A06		overlay nameplate for bezel (one-frequency models with busy light option)
29	5-7703	nut for strain relief bracket, 2 used
30	7-80100A01	strain relief bracket
31	4-7555	flat washer for strain relief bracket, 2 used
32	7-80159A01	pushbutton switch bracket
33	46-80127A01	pushbutton switch S100
34	32-80038C01	connector gasket
35	1-80703T51	connector (J101)
36	18-80126A01	rotary potentiometer R102
37	46-80111A01	rotary switch S102 (see electrical parts list)
38	18-80108A02	rotary potentiometer R101 (pin S101)
39	3-10906B04	flathead machine screw for front housing, (M3.5 x 0.6 x 13), 2 used
40	4-7855	lockwasher for frequency switch bracket
41	2-1376	nut for frequency switch bracket
42	32-80131B01	microphone gasket (weather-resistant models only)
non-referenced items		
	3-139913	tapping screw (8-15 x 1/4), 2 used
	3-136756	tapping screw (10-16 x 1/4), 3 used
	37-80118A01	grommet
	36-84383D02	protective cap
	42-10113A32	retainer ring

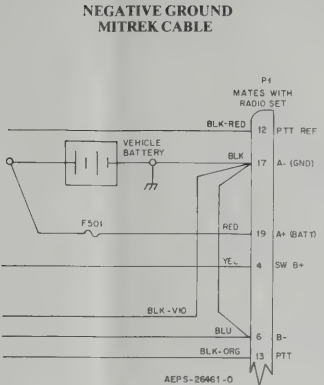


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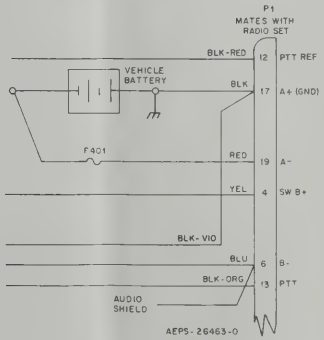
FIELD CONVERSION OF RADIO CABLES

In some instances, it may be necessary or desirable to make field conversion of cables to facilitate a particular installation. Two examples of this would be to install a new MITREK radio in a positive ground vehicle when only a negative ground cable was available or to retrofit a MITREK radio into an existing positive ground MOCOM*70 installation. In both of these the resulting cable should be clearly tagged as its wire colors will not match any existing documentation.

NOTE
When converting to positive ground, JU1 on the interconnect board in the radio must be cut.



POSITIVE GROUND MOCOM*70 CABLE



CONVERSION PROCEDURE

Step 1. Unsolder the wires from the following pins at the connector to the radio set:

Wire Color	Pin
Blk-Red	12
Blk, Blk-Vio, Jumper	17
Red	19
Yel	4
Blu, Jumper	6
Blk-Org	13

Step 2. Resolder the wires to the following pins:

Wire Color	Pin
Blk-Red	13
Blk, Jumper	19
Red	17
Yel, Blu	6
Blk-Vio, Jumper	4
Blk-Org	12

Step 3. Attach a tag to the cable near the radio connector documenting the changes that have been made.

CONVERSION PROCEDURE

Step 1. Unsolder the wires from the following pins at the connector to the radio set:

Wire Color	Pin
Blk-Red	12
Blk, Blk-Vio,	17
Red	19
Yel	4
*Blu, Audio Shield	6
Blk-Org	13

*Blu lead may be omitted on single frequency models.

Step 2. Resolder the wires to the following pins

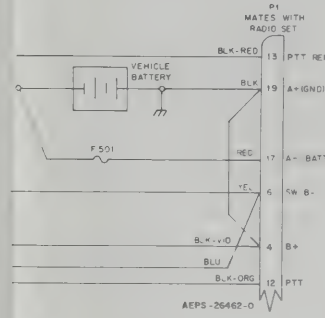
Wire Color	Pin
Blk-Red	13
Blk	19
Red	17
Yel, Blu*	6
Blk-Vio	4
Blk-Org	12
Audio Shield	2

*Blu lead may be omitted on single frequency models.

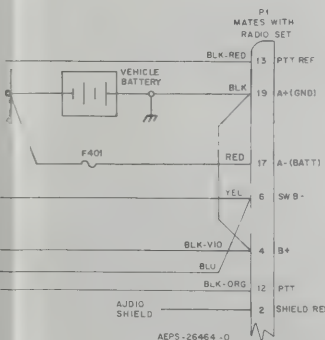
Step 3. Solder a short jumper (insulated #24 or larger wire) between pin 4 and pin 19.

Step 4. Attach a tag to the cable near the radio connector documenting the changes that have been made.

NEGATIVE GROUND MITREK CABLE MODIFIED FOR POSITIVE GROUND INSTALLATION



POSITIVE GROUND MOCOM*70 CABLE MODIFIED FOR POSITIVE GROUND MITREK INSTALLATION





MOTOROLA INC.

**Communications
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instruction manual revision

Supersedes WMR-0091

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct the manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P80100W30-O	<i>Motrek</i> Two-Way FM Radio; 150.8 – 162 MHz; 35/55/100 Watts
68P80100W35-O	<i>Motrek</i> Two-Way FM Radio; 450 – 470 MHz; 30/45/90 Watts
68P81045E65-O	<i>Mitrek</i> Two-Way FM Radio; 29.7 – 50 MHz, 60/110 Watts
68P81045E70-O	<i>Mitrek</i> Two-Way FM Radio; 136 – 174 MHz, 40/60/75/110 Watts
68P81045E75-A	<i>Mitrek</i> Two-Way FM Radio; 406 – 420 MHz and 450 – 412 MHz, 30/50 Watts, 75/100 Watts
68P81045E80-O	<i>Mitrek</i> Two-Way FM Radio; 806 – 816 MHz Transmit, 851 – 861 MHz Receive, 12/35 Watts
68P81046E05-B	<i>Mitrek Plus</i> Two-Way FM Radio, Options B432 and B486

REVISION DETAILS:

1. In Instruction Manual **68P80100W30-O**:

- A. Page iv, Model Chart EPW-0045-O, change "HLN4044A" to "HLN4044B."
- B. Instruction Section **68P80100W06-O** (Sheet 3 of 5), substitute Parts List PL-6030-F, attached, for Parts List PL-6030-E.
- C. Instruction Section **68P80100W06-O** (Sheet 4 of 5), Diagram EEPW-0085-O, the interconnect board section, change the title "HLN4044A INTERCONNECT BOARD" to "HLN4044A,B INTERCONNECT BOARDS."

2. In Instruction Manual **68P80100W35-O**:

- A. Page iv, Model Chart EPW-0049-O, change "HLN4044A" to "HLN4044B."
- B. Instruction Section **68P80100W04-O** (Sheet 3 of 5), substitute Parts List PL-6030-F, attached, for Parts List PL-6030-E.

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WMR-0095
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3. In Instruction Manual **68P81045E65-O**:

- A. Page iii, Model Chart EPS-30272-O, change “HLN4044A” to “HLN4044B.”
- B. Instruction Section **68P81039E33-C** (Sheet 1 of 5), replace Parts List PL-6030-E with PL-6030-F (attached).
- C. Instruction Section **68P81039E33-C** (Sheet 2 of 5), Diagram EEPS-27788-A, the interconnect board section, change the title “HLN4044A INTERCONNECT BOARD” to “HLN4044A,B INTERCONNECT BOARDS.”

4. In Instruction Manual **68P81045E70-O**:

- A. Page iv, Model Chart EPS-29766-O, change “HLN4044A” to “HLN4044B.”
- B. Instruction Section **68P81039E29-C/D** (Sheet 3 of 5), replace Parts List PL-6030-E with PL-6030-F (attached).
- C. Instruction Section **68P81039E29-C** (Sheet 4 of 5), Diagram EEPS-26056-C, the interconnect board section, change the title “HLN4044A INTERCONNECT BOARD” to “HLN4044A,B INTERCONNECT BOARDS.”

5. In Instruction Manual **68P81045E75-A**:

- A. Page iv, Model Chart EPW-0032-O, change “HLN4044A” to “HLN4044B.”
- B. Instruction Section **68P81039E21-D** (Sheet 3 of 5), replace Parts List PL-6030-E with PL-6030-F (attached).

6. In Instruction Manual **68P81045E80-O**:

- A. Page iii, Model Chart EPS-31266-A, change “HUF1001A” to “HUF1001B” and change “HUF1005A” to “HUF1005B.”
- B. Page iv, Model Chart EPS-81287-O, make the following changes:

from	to
HUF1001A	HUF1001B
HUF1005A	HUF1005B
HUF1002A	HUF1002B
HUF1006A	HUF1006B
HLN4044A	HLN4192B

- C. Instruction Section **68P81046E88-O** (Sheet 6 of 8), Diagram EEPS-30058-A, change the title “HLN4044A INTERCONNECT BOARD” to “HLN4044A,B INTERCONNECT BOARDS.”

7. In Instruction Manual **68P81046E05-B**:

A. Page 1, Section 2.2, *Table 3*, make the following changes:

from	to
HUE1073B	HUE1073C
HUE1074B	HUE1074C
HUE1083B	HUE1083C
HUE1084B	HUE1084C
HUE1116B	HUE1116C
HUE1094B	HUE1094C

Change all "HLN4192A" kit numbers to "HLN4192B."

B. Page 2, Section 2.3, *Table 4*, make the following changes:

from	to
HUD1053B	HUD1053C
HUD1054B	HUD1054C
HUD1063B	HUD1063C
HUD1064B	HUD1064C
HUD1074B	HUD1074C
HUD1082B	HUD1082C

Change all "HLN4192A" kit numbers to "HLN4192B."

C. Page 2, Section 2.4, *Table 5*, make the following changes:

from	to
HUB1043B	HUB1043C
HUB1044B	HUB1044C
HUB1053B	HUB1053C
HUB1054B	HUB1054C
HUB1063B	HUB1063C
HUB1064B	HUB1064C
HUB1073B	HUB1073C
HUB1074B	HUB1074C

Change all "HLN4192A" kit numbers to "HLN4192B."

D. Page 2, Section 3.1.3; Page 3, Section 3.2.3; and Page 4, Section 3.3.2: change "HLN4192A" to "HLN4192B" and "HLN4044A" to "HLN4044B," and change "(Motorola Part No. 23-83210A24 or 23-80167C01)" to "(Motorola Part No. 23-80167C02)."

E. *Table 8* and *Table 10* on Page 3, and *Table 11* on Page 4, U401 and U402, change "51-80274B01" to "51-80065C03" and change "type M7401" to "I.C. Audio."

F. Behind Page 5, insert the attached Parts List MXW-0411-O.

parts list

HLN4044B Interconnect Board

PL-6030-F

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2	23-83210A19	capacitor, fixed: 500 μ F \pm 100, -10% ; 20 V 10 μ F \pm 100, -10% ; 25 V 470 pF \pm 20%, 25 V (feedthru)
C3	23-84665F01	
C11 - 29	21-84874K01	
CR1	48-82525G19	diode (see note): silicon silicon silicon silicon
CR2	48-83654H01	
CR3	1-80701T74	
CR4	48-82466H18	
J1	1-80701T74	connector, receptacle: CONNECTOR, assembly; includes C11 - 29 female; 9-contact female; 25-contact
J3	9-80159F02	
J10	9-80159F03	
R2	6-11009C65	resistor, fixed: 1.8k \pm 10%; $\frac{1}{4}$ W 220 \pm 10%; $\frac{1}{4}$ W
R4	6-11009C33	
mechanical parts		
	42-80088A01	CLIP, option

note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.

HLN4192B Interconnect Board

MXW-0411-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2	23-80167C02	capacitor, fixed: 1000 μ F \pm 20%; 25 V 4.7 μ F \pm 10%, 25 V 470 pF \pm 20%, 25 V (feedthru)
C3	23-82783B25	
C11 – 29	21-84874K01	
CR1	48-82525G19	diode (see note): silicon silicon silicon silicon
CR2	48-83654H01	
CR3	1-80701T74	
CR4	48-82466H18	
J1	1-80701T74	connector, receptacle: CONNECTOR, assembly; includes C11 – 29 female; 9-contact female; 25-contact
J3	9-80159F02	
J10	9-80159F03	
R2	6-11009C65	resistor, fixed: 1.8k \pm 10%; $\frac{1}{4}$ W 220 \pm 10%; $\frac{1}{4}$ W
R4	6-11009C33	
mechanical parts		
	42-80088A01	CLIP, option

note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.



MOTOROLA INC.

**Communications
Group**

instruction manual revision

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct the manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E65-O	<i>Mitrek Two-Way FM Radio; 29.7 – 50 MHz, 60/110 Watts</i>
68P81045E70-O	<i>Mitrek Two-Way FM Radio; 136 – 174 MHz, 40/60/75/110 Watts</i>
68P81045E75-A	<i>Mitrek Two-Way FM Radio; 406 – 420 MHz and 450 – 412 MHz, 30/50 Watts, 75/100 Watts</i>

REVISION DETAILS:

1. In Instruction Manual **68P81045E65-O**:
 - A. Replace present Pages i, ii, iii, and iv with attached Pages i, ii, iii, and iv.
 - B. Revise the applicable standard specifications on Page vi by substituting the higher values given in *Table 1* (Page 1) of attached Instruction Manual **68P81046E05-B**.
2. In Instruction Manual **68P81045E70-O**:
 - A. Replace present Pages iii and iv with attached Pages iii and iv.
 - B. Revise the applicable standard specifications on Page vi by substituting the higher values given in *Table 1* (Page 1) of attached Instruction Manual **68P81046E05-B**.
3. In Instruction Manual **68P81045E75-A**:
 - A. Replace the present Pages iii and iv with the attached Pages iii and iv.
 - B. Revise the applicable standard specifications on Page vi by substituting the higher values given in *Table 1* (Page 1) of attached Instruction Manual **68P81046E05-B**.

1 of 1

technical publication services

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WMR-0096

2/28/83

UNIT 1: Introduction to the course

Objectives of the course
What you will learn
How the course is organized

The course is designed to provide a comprehensive overview of the subject matter. It covers the following topics:

- Topic 1: Introduction to the field
- Topic 2: Key concepts and theories
- Topic 3: Practical applications
- Topic 4: Current research and developments
- Topic 5: Future prospects

The course is structured to allow students to progress at their own pace. It includes a variety of learning activities, including lectures, seminars, and practical exercises. Assessment is based on a combination of written and oral work.

Student Name	
Student ID	
Signature	



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MITREK TWO-WAY FM RADIO

29.7-50 MHz
60/110 Watts

CONTENTS

SECTION	NUMBER
OPERATION	Inside Cover
Model Chart	Page ii
Unified Chassis Chart	Page iii
PA Breakdown and Options Chart	Page v
Specifications	Page vi
Foreword	Pages vii, viii
GENERAL SAFETY INFORMATION	68P81045E71
INSTALLATION	68P81109E32
Installation Considerations	(Sheet 1 of 2)
Installation Procedures	(Sheet 2 of 2)
THEORY OF OPERATION	Page 1
General	Page 1
Meter 4 Circuit	Page 1
Power Control and Protection Circuit	Page 2
Bridge Audio Circuit	Page 3
MAINTENANCE	Page 3
General	Page 3
Radio Set Disassembly	Page 3
Power Amplifier	Page 3
Ignition Noise and Anti-Skid Braking	Page 4
ALIGNMENT	
Test Equipment List and Receiver Transmitter Alignment	PEPS-27787
Receiver Alignment	PEPS-26665
Functional Block Diagram	Page 7
INSTRUCTION SECTIONS	
Transmitter Section, Time-Out Timer, and Interconnect Board	
Parts Lists and Circuit Board Details	68P81039E33 (Sheet 1 of 5)
Transmitter Section Schematic Diagram	68P81039E33 (Sheet 2 of 5)
Receiver Section and Busy Light Adapter Board Circuit Board	
Details and Parts Lists	68P81039E33 (Sheet 3 of 5)
Receiver Section Schematic Diagram	68P81039E33 (Sheet 4 of 5)
Radio Set Mechanical Parts	68P81039E33 (Sheet 5 of 5)
Lock Removal Procedure	68P81039E33 (Sheet 5 of 5)
Low Band 60 Watt Power Amplifier, Instruction Section	68P81039E34
Low Band 110 Watt Power Amplifier, Instruction Section	68P81041E62
HLN4181A Solid State Private-Line™ Encoder-Decoder, Instruction Section	68P80200W06
HLN4011A Digital Private-Line™ Encoder-Decoder, Instruction Section	68P81039E23
TLN5730A Digital Private-Line™ Two-Code Adapter, Instruction Section	68P81106E97
MITREK Accessories, Instruction Section	68P81039E26
MITREK Control Head and Cables, Instruction Section	68P81039E24

MODEL	DESCRIPTION			
	CARRIER SQUELCH			
T51JJA1000CK	RADIO SET, 60-WATT; 1-FREQUENCY			
T51JJA1900CK	RADIO SET, 60-WATT; 4-FREQUENCY			
T51JJA2000CK	RADIO SET WITH EXTENDER, 60-WATT; 1-FREQUENCY			
T51JJA2900CK	RADIO SET WITH EXTENDER, 60-WATT; 4-FREQUENCY			
	PRIVATE-LINE			
T51JJA3000DK	RADIO SET, 60-WATT; 1-FREQUENCY			
T51JJA3900DK	RADIO SET, 60-WATT; 4-FREQUENCY			
T51JJA4000DK	RADIO SET WITH EXTENDER, 60-WATT; 1-FREQUENCY			
T51JJA4900DK	RADIO SET WITH EXTENDER, 60-WATT; 4-FREQUENCY			
	DIGITAL PRIVATE-LINE			
T51JJA6000CK	RADIO SET, 60-WATT; 1-FREQUENCY			
T51JJA6900CK	RADIO SET, 60-WATT; 4-FREQUENCY			
T51JJA8000CK	RADIO SET WITH EXTENDER, 60-WATT; 1-FREQUENCY			
T51JJA8900CK	RADIO SET WITH EXTENDER, 60-WATT; 4-FREQUENCY			
	CARRIER SQUELCH			
T81JJA1000CK	RADIO SET, 110-WATT; 1-FREQUENCY			
T81JJA1900CK	RADIO SET, 110-WATT; 4-FREQUENCY			
T81JJA2000CK	RADIO SET WITH EXTENDER, 110-WATT; 1-FREQUENCY			
T81JJA2900CK	RADIO SET WITH EXTENDER, 110-WATT; 4-FREQUENCY			
	PRIVATE-LINE			
T81JJA3000DK	RADIO SET, 110-WATT; 1-FREQUENCY			
T81JJA3900DK	RADIO SET, 110-WATT; 4-FREQUENCY			
T81JJA4000DK	RADIO SET WITH EXTENDER, 110-WATT; 1-FREQUENCY			
T81JJA4900DK	RADIO SET WITH EXTENDER, 110-WATT; 4-FREQUENCY			
	DIGITAL PRIVATE-LINE			
T81JJA6000CK	RADIO SET, 110-WATT; 1-FREQUENCY			
T81JJA6900CK	RADIO SET, 110-WATT; 4-FREQUENCY			
T81JJA8000CK	RADIO SET WITH EXTENDER, 110-WATT; 1-FREQUENCY			
T81JJA8900CK	RADIO SET WITH EXTENDER, 110-WATT; 4-FREQUENCY			

MODEL CHART FOR MITREK MOBILE RADIO 1 - 4 FREQUENCY 60 AND 110 WATT RF POWER 29.7 - 50 MHz

CODE:

- = ONE ITEM SUPPLIED
- = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE
- 4 = NUMBER INDICATES QUANTITY SUPPLIED
- ★ = INDICATES BREAKDOWN ON SEPARATE CHART

ITEM	DESCRIPTION
★ HJB1043C	CHASSIS NON-EXTENDER (29.7 - 38.999 MHz) 60-WATT
★ HJB1044C	CHASSIS NON-EXTENDER (39 - 50 MHz) 60-WATT
★ HJB1063C	CHASSIS WITH EXTENDER (29.7 - 38.999 MHz) 60-WATT
★ HJB1064C	CHASSIS WITH EXTENDER (39 - 50 MHz) 60-WATT
★ HJB1053C	CHASSIS NON-EXTENDER (29.7 - 38.999 MHz) 110-WATT
★ HJB1054C	CHASSIS NON-EXTENDER (39 - 50 MHz) 110-WATT
★ HJB1073C	CHASSIS WITH EXTENDER (29.7 - 38.999 MHz) 110-WATT
★ HJB1074C	CHASSIS WITH EXTENDER (39 - 50 MHz) 110-WATT
HJA4181A	SOLID STATE PRIVATE-LINE ENCODER/DECODER
HJA4011A	DIGITAL PRIVATE-LINE ENCODER/DECODER
TRW4224A	CODE PLUG
TRW5005A	CODE PLUG
KON1085A	CHANNEL ELEMENT, RECEIVER
KON1087A	CHANNEL ELEMENT, TRANSMITTER
HKN4200A	HOUSING, TOP COVER, LOW-POWER
HKN4300A	HOUSING, TOP COVER, HIGH-POWER
HJA4334A	HOUSING, BOTTOM COVER
HON4000A	CONTROL HEAD (1-FREQUENCY) CARRIER SQUELCH
HON4001A	CONTROL HEAD (4-FREQUENCY) CARRIER SQUELCH
HON4002A	CONTROL HEAD (1-FREQUENCY) PRIVATE-LINE
HON4003A	CONTROL HEAD (4-FREQUENCY) PRIVATE-LINE
HMN4000A	MICROPHONE
HSN4009A	SPEAKER
HKN4000A	CABLE (17') 1-FREQUENCY
HKN4001A	CABLE (17') 4-FREQUENCY
HKN4016A	CABLE (17') 1-FREQUENCY
HKN4017A	CABLE (17') 4-FREQUENCY
HJA4024A	MICROPHONE HANGUP BOX
TAB1001C	ANTENNA (25 - 30 MHz)
TAB1002C	ANTENNA (30 - 54 MHz)
HJA4022A	INSTALLATION KIT
HJA4023A	TUNING TOOL KIT
HKN4041A	FUSED LEAD

EPW-0111-A

CODE:

- = ONE ITEM SUPPLIED
- = SEE FURTHER BREAKDOWN IN THIS CHART
- ★ = SEE FURTHER BREAKDOWN IN SEPARATE CHART

EPS-30272-A

**MODEL CHART
FOR
MITREK MOBILE RADIO
146 – 174 MHz
1 – 4 FREQUENCY
40/60/75/110-WATT RF POWER**

CODE:

- = ONE ITEM SUPPLIED
- / = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- 4 = NUMBER INDICATES QUANTITY SUPPLIED
- = INDICATES BREAKDOWN ON SEPARATE CHART

MODEL	DESCRIPTION	ITEM	DESCRIPTION
T43JUA1000CK T43JUA1800CK T53JUA1000CK T53JUA1800CK T63JUA1000CK T63JUA1800CK T83JUA1000CK T83JUA1800CK	CARRIER SQUELCH	■ HUD1053C	CHASSIS, 136 – 146 MHz (40-WATT)
	RADIO SET, 40-WATT; 1-FREQUENCY	■ HUD1054C	CHASSIS, 146 – 174 MHz (40-WATT)
	RADIO SET, 40-WATT; 4-FREQUENCY	■ HUD1063C	CHASSIS, 136 – 146 MHz (60-WATT)
	RADIO SET, 60-WATT; 1-FREQUENCY	■ HUD1064C	CHASSIS, 146 – 174 MHz (60-WATT)
	RADIO SET, 60-WATT; 4-FREQUENCY	■ HUD1082C	CHASSIS, 136 – 146 MHz (75/110-WATT)
	RADIO SET, 75-WATT; 1-FREQUENCY	■ HUD1074C	CHASSIS, 146 – 174 MHz (75/110-WATT)
	RADIO SET, 75-WATT; 4-FREQUENCY	HLN4181A	PRIVATE-LINE BOARD
	RADIO SET, 110-WATT; 1-FREQUENCY	HLN4011A	DIGITAL PRIVATE-LINE BOARD
T43JUA3000CK T43JUA3900CK T53JUA3000CK T53JUA3900CK T63JUA3000CK T63JUA3900CK T83JUA3000CK T83JUA3900CK	PRIVATE-LINE	TRN6005A	CODE PLUG
	RADIO SET, 40-WATT; 1-FREQUENCY	TRN4224A	CODE PLUG
	RADIO SET, 40-WATT; 4-FREQUENCY	KXN1086B	CHANNEL ELEMENT, RECEIVER
	RADIO SET, 60-WATT; 1-FREQUENCY	KXN1088A	CHANNEL ELEMENT, TRANSMITTER
	RADIO SET, 60-WATT; 4-FREQUENCY	HHN4000A	HOUSING, TOP COVER, LOW-POWER
	RADIO SET, 75-WATT; 1-FREQUENCY	HHN4001A	HOUSING, TOP COVER, HIGH-POWER
	RADIO SET, 75-WATT; 4-FREQUENCY	HLN4034A	HOUSING, BOTTOM COVER
	RADIO SET, 110-WATT; 1-FREQUENCY	HCN4000A	CONTROL HEAD, 1-FREQUENCY, CARRIER SQUELCH
T43JUA6000CK T43JUA6900CK T53JUA6000CK T53JUA6900CK T63JUA6000CK T63JUA6900CK T83JUA6000CK T83JUA6900CK	DIGITAL PRIVATE-LINE	HCN4001A	CONTROL HEAD, 4-FREQUENCY, CARRIER SQUELCH
	RADIO SET, 40-WATT; 1-FREQUENCY	HCN4002A	CONTROL HEAD, 1-FREQUENCY, PRIVATE-LINE
	RADIO SET, 40-WATT; 4-FREQUENCY	HCN4003A	CONTROL HEAD, 4-FREQUENCY, PRIVATE-LINE
	RADIO SET, 60-WATT; 1-FREQUENCY	HMN4000A	MICROPHONE
	RADIO SET, 60-WATT; 4-FREQUENCY	HSN4009A	SPEAKER
	RADIO SET, 75-WATT; 1-FREQUENCY	HKN4000A	CABLE (17') 1-FREQUENCY
	RADIO SET, 75-WATT; 4-FREQUENCY	HKN4001A	CABLE (17') 4-FREQUENCY
	RADIO SET, 110-WATT; 1-FREQUENCY	HKN4016A	CABLE (17') 1-FREQUENCY
		HKN4017A	CABLE (17') 4-FREQUENCY
		HLN4024A	MICROPHONE HANGUP BOX
		TAD6111A	ANTENNA, ROOFTOP (136 – 144 MHz)
		TAD6112A	ANTENNA, ROOFTOP (144 – 152 MHz)
		TAD6113A	ANTENNA, ROOFTOP (152 – 162 MHz)
		TAD6014A	ANTENNA, ROOFTOP (162 – 174 MHz)
		HLN4022A	INSTALLATION KIT
		HLN4023A	TUNING TOOL KIT
		HKN4041A	FUSE LEAD

EPS-27385-C

● = ONE ITEM SUPPLIED
■ = SEE FURTHER BREAKDOWN IN THIS CHART
★ = SEE FURTHER BREAKDOWN IN SEPARATE CHART

EPS-29766-A

**MODEL CHART
FOR
UHF MITREK MOBILE RADIO
(406 – 420 MHz) 30/50/100 W
(450 – 470 MHz) 30/50/75/100 W
(470 – 512 MHz) 19/39/59/75 W
(50/100/150/200 W ERP)**

CODE:

- = ONE ITEM SUPPLIED
- / = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- 4 = QUANTITY SUPPLIED
- = BREAKDOWN ON SEPARATE CHART

MODEL	DESCRIPTION	MODEL	DESCRIPTION
T34JJA1000CK	30-WATT MODELS 1-FREQUENCY CARRIER SQUELCH		
T34JJA1900CK	4-FREQUENCY CARRIER SQUELCH		
T34JJA3000DK	1-FREQUENCY PRIVATE-LINE		
T34JJA3900DK	4-FREQUENCY PRIVATE-LINE		
T34JJA6000CK	1-FREQUENCY DIGITAL PRIVATE-LINE		
T34JJA6900CK	4-FREQUENCY DIGITAL PRIVATE-LINE		
T44JJA1000CK	50-WATT MODELS 1-FREQUENCY CARRIER SQUELCH		
T44JJA1800CK	4-FREQUENCY CARRIER SQUELCH		
T44JJA3000DK	1-FREQUENCY PRIVATE-LINE		
T44JJA3900DK	4-FREQUENCY PRIVATE-LINE		
T44JJA6000CK	1-FREQUENCY DIGITAL PRIVATE-LINE		
T44JJA6900CK	4-FREQUENCY DIGITAL PRIVATE-LINE		
T64JJA1000CK	75-WATT MODELS 1-FREQUENCY CARRIER SQUELCH		
T64JJA1900CK	4-FREQUENCY CARRIER SQUELCH		
T64JJA3000DK	1-FREQUENCY PRIVATE-LINE		
T64JJA3900DK	4-FREQUENCY PRIVATE-LINE		
T64JJA6000CK	1-FREQUENCY DIGITAL PRIVATE-LINE		
T64JJA6900CK	4-FREQUENCY DIGITAL PRIVATE-LINE		
T74JJA1000CK	100-WATT MODELS 1-FREQUENCY CARRIER SQUELCH		
T74JJA1900CK	4-FREQUENCY CARRIER SQUELCH		
T74JJA3000DK	1-FREQUENCY PRIVATE-LINE		
T74JJA3900DK	4-FREQUENCY PRIVATE-LINE		
T74JJA6000CK	1-FREQUENCY DIGITAL PRIVATE-LINE		
T74JJA6900CK	4-FREQUENCY DIGITAL PRIVATE-LINE		
		ITEM	DESCRIPTION
		■ HUE1073C	UNIFIED CHASSIS, 30-WATT (406 – 420 MHz)
		■ HUE1074C	UNIFIED CHASSIS, 30-WATT (450 – 470 MHz)
		■ HUE1157B	UNIFIED CHASSIS, 30-WATT (470 – 512 MHz)
		■ HUE1083C	UNIFIED CHASSIS, 50-WATT (406 – 420 MHz)
		■ HUE1084C	UNIFIED CHASSIS, 50-WATT (450 – 470 MHz)
		■ HUE1161C	UNIFIED CHASSIS, 50-WATT (470 – 512 MHz)
		■ HUE1116C	UNIFIED CHASSIS, 100/75-WATT (406 – 420 MHz)
		■ HUE1094C	UNIFIED CHASSIS, 100/75-WATT (450 – 470 MHz)
		■ HUE1095C	UNIFIED CHASSIS, 100/75-WATT (470 – 494 MHz)
		■ HUE1156B	UNIFIED CHASSIS, 100/75-WATT (494 – 512 MHz)
		HLN4181B	PRIVATE-LINE BOARD
		HLN4011A	DIGITAL PRIVATE-LINE BOARD
		TRN4224A	CODE PLUG
		TRN6005A	CODE PLUG
		KXN1086B	CHANNEL ELEMENT RECEIVER
		KXN1088A	CHANNEL ELEMENT TRANSMITTER
		HHN4000A	HOUSING, TOP COVER, LOW-POWER
		HHN4001A	HOUSING, TOP COVER, HIGH-POWER
		HLN4034A	HOUSING, BOTTOM COVER
		HCN4000A	CONTROL HEAD (1-FREQUENCY), CARRIER SQUELCH
		HCN4001A	CONTROL HEAD (4-FREQUENCY), CARRIER SQUELCH
		HCN4002A	CONTROL HEAD (1-FREQUENCY), PRIVATE-LINE
		HCN4003A	CONTROL HEAD (4-FREQUENCY), PRIVATE-LINE
		HMN4000B	MICROPHONE
		HSN4009A	SPEAKER
		HKN4000A	CONTROL CABLE (17-FT), 1-FREQUENCY
		HKN4001A	CONTROL CABLE (17-FT), 4-FREQUENCY
		HKN4016A	CONTROL CABLE (17-FT), 1-FREQUENCY, HIGH-POWER
		HKN4017A	CONTROL CABLE (17-FT), 4-FREQUENCY, HIGH-POWER
		HKN4041A	CABLE, FUSE AND RED LEAD, HIGH-POWER
		HLN4024A	MICROPHONE HANGUP BOX
		TAE6061B	ANTENNA (406 – 430 MHz)
		TAE6062B	ANTENNA (450 – 470 MHz)
		TAE6094B	ANTENNA (470 – 494 MHz)
		TAE6095B	ANTENNA (494 – 512 MHz)
		HLN4022A	INSTALLATION KIT
		HLN4023A	TUNING TOOL KIT

EPW-0031-B

MODEL CHART FOR UNIFIED CHASSIS MITREK TWO-WAY FM RADIO 406 – 420 MHz 450 – 470 MHz 470 – 512 MHz 30/50/75/100 WATTS

CODE:

● = ONE ITEM SUPPLIED

■ = BREAKDOWN ON SEPARATE CHART

MODEL	DESCRIPTION
HUE1073C	UNIFIED CHASSIS, 30-WATT (406 – 420 MHz)
HUE1074C	UNIFIED CHASSIS, 30-WATT (450 – 470 MHz)
HUE1157B	UNIFIED CHASSIS, 30-WATT (470 – 512 MHz)
HUE1083C	UNIFIED CHASSIS, 50-WATT (406 – 420 MHz)
HUE1084C	UNIFIED CHASSIS, 50-WATT (450 – 470 MHz)
HUE1161C	UNIFIED CHASSIS, 50-WATT (470 – 512 MHz)
HUE1116C	UNIFIED CHASSIS, 75/100-WATT (406 – 420 MHz)
HUE1094C	UNIFIED CHASSIS, 75/100-WATT (450 – 470 MHz)
HUE1095C	UNIFIED CHASSIS, 75/100-WATT (470 – 494 MHz)
HUE1158B	UNIFIED CHASSIS, 75/100-WATT (494 – 512 MHz)
HUE1071C	UNIFIED CHASSIS, 30-WATT (406 – 420 MHz)
HUE1072C	UNIFIED CHASSIS, 30-WATT (450 – 470 MHz)
HUE1159B	UNIFIED CHASSIS, 30-WATT (470 – 512 MHz)
HUE1081C	UNIFIED CHASSIS, 50-WATT (406 – 420 MHz)
HUE1082C	UNIFIED CHASSIS, 50-WATT (450 – 470 MHz)
HUE1163B	UNIFIED CHASSIS, 50-WATT (470 – 512 MHz)
HUE1118C	UNIFIED CHASSIS, 75/100-WATT (406 – 420 MHz)
HUE1092C	UNIFIED CHASSIS, 75/100-WATT (450 – 470 MHz)
HUE1093C	UNIFIED CHASSIS, 75/100-WATT (470 – 494 MHz)
HUE1158B	UNIFIED CHASSIS, 75/100-WATT (494 – 512 MHz)

ITEM	DESCRIPTION
HUE1071C	UNIFIED CHASSIS, 30-WATT (406 – 420 MHz)
HUE1072C	UNIFIED CHASSIS, 30-WATT (450 – 470 MHz)
HUE1159B	UNIFIED CHASSIS, 30-WATT (470 – 512 MHz)
HUE1081C	UNIFIED CHASSIS, 50-WATT (406 – 420 MHz)
HUE1082C	UNIFIED CHASSIS, 50-WATT (450 – 470 MHz)
HUE1163B	UNIFIED CHASSIS, 50-WATT (470 – 512 MHz)
HUE1118C	UNIFIED CHASSIS, 75/100-WATT (406 – 420 MHz)
HUE1092C	UNIFIED CHASSIS, 75/100-WATT (450 – 470 MHz)
HUE1093C	UNIFIED CHASSIS, 75/100-WATT (470 – 494 MHz)
HUE1158B	UNIFIED CHASSIS, 75/100-WATT (494 – 512 MHz)
■ HLE1001C	POWER AMPLIFIER, 30-WATT (406 – 420 MHz)
■ HLE1002C	POWER AMPLIFIER, 30-WATT (450 – 512 MHz)
■ HLE1011C	POWER AMPLIFIER, 50-WATT (406 – 420 MHz)
■ HLE1012C	POWER AMPLIFIER, 50-WATT (450 – 512 MHz)
■ HLE1031B	POWER AMPLIFIER, 75/100-WATT (406 – 420 MHz)
■ HLE1032B	POWER AMPLIFIER, 75/100-WATT (450 – 492 MHz)
■ HLE1033B	POWER AMPLIFIER, 75/100-WATT (494 – 512 MHz)
HLE4121B	MAIN BOARD, UHF (406 – 420 MHz)
HLE4122B	MAIN BOARD, UHF (450 – 470 MHz)
HLE4123A	MAIN BOARD, UHF (470 – 512 MHz)
HLE4105A	RF DECK, UHF (406 – 420 MHz)
HLE4106A	RF DECK, UHF (450 – 470 MHz)
HLE4107A	RF DECK, UHF (470 – 512 MHz)
HLN4195B	HARDWARE KIT
HLN4033A	BOTTOM COVER, INNER, AND GASKET
HLN4019A	HARDWARE WIRING KIT
HLN4192B	INTERCONNECT BOARD
HLN4198B	HARDWARE KIT, HIGH-POWER, 75/100-WATT
HLN4047A	HARDWARE WIRING KIT, HIGH-POWER
HLN4189A	HARDWARE

EPW-0032-A



MOTOROLA INC.

**Communications
Group**

instruction manual revision

Supersedes WMR-0008

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct the manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E65-O	<i>Mitrek Two-Way FM Radio, 29.7 – 50 MHz</i>
68P81045E70-O	<i>Mitrek Two-Way FM Radio, 136 – 174 MHz</i>
68P81045E75-A	<i>Mitrek Two-Way FM Radio, 406 – 420 MHz and 450 - 512 MHz</i>

REVISION DETAILS:

In your manual, delete Instruction Sections 68P81106E97-B and 68P81039E26-C/G, and add the attached Instruction Sections 68P81106E97-B and 68P81039E26-H.

1 of 1

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Fort Worth, Texas 76137
Attn:- Technical Publication Services

WMR-0099

12-13-83 GG

"DIGITAL PRIVATE-LINE" TWO-CODE ADAPTER

MODEL TLN5730A

APPLICATION —

Plugs into code plug receptacle on "Digital Private-Line" decoder or encoder-decoder to allow separate "Digital Private-Line" codes for transmit and receive. Code plugs for the two codes then plug into the receptacles on the two-code adapter board.

parts list

TLN5730A 2-Code Adapter Board

PL-3414-O

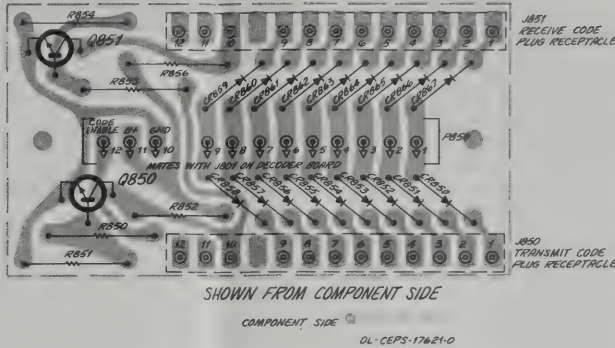
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR850 - 867	48-83654H01	diode (see note): silicon
J850, 851	9-82071K01	connector, receptacle: female; 12-contact
P850	28-82070K01	connector, plug: consists of: CONTACT, male; 13 req'd
Q850, 851	48-869642	transistor (see note): NPN; type M9642
R850, 852, 853, 856	6-124A73	resistor, fixed: 10k $\pm 5\%$; $\frac{1}{4}$ W
R851, 854	6-124A65	4.7k $\pm 5\%$; $\frac{1}{4}$ W
non-referenced items		
	1V80769B88	CIRCUIT BOARD ASSY., incl. referenced item P850
	3-138804	SCREW, machine (4-40 x $\frac{5}{16}$ "); 2 req'd.

note: For best performance, order diodes and transistors by Motorola part number.

DPL TWO-CODE ADAPTER/MITREK ACCESSORIES

68P81106E97-B

“DIGITAL PRIVATE-LINE”
TWO-CODE ADAPTER
MODEL TLN5730A



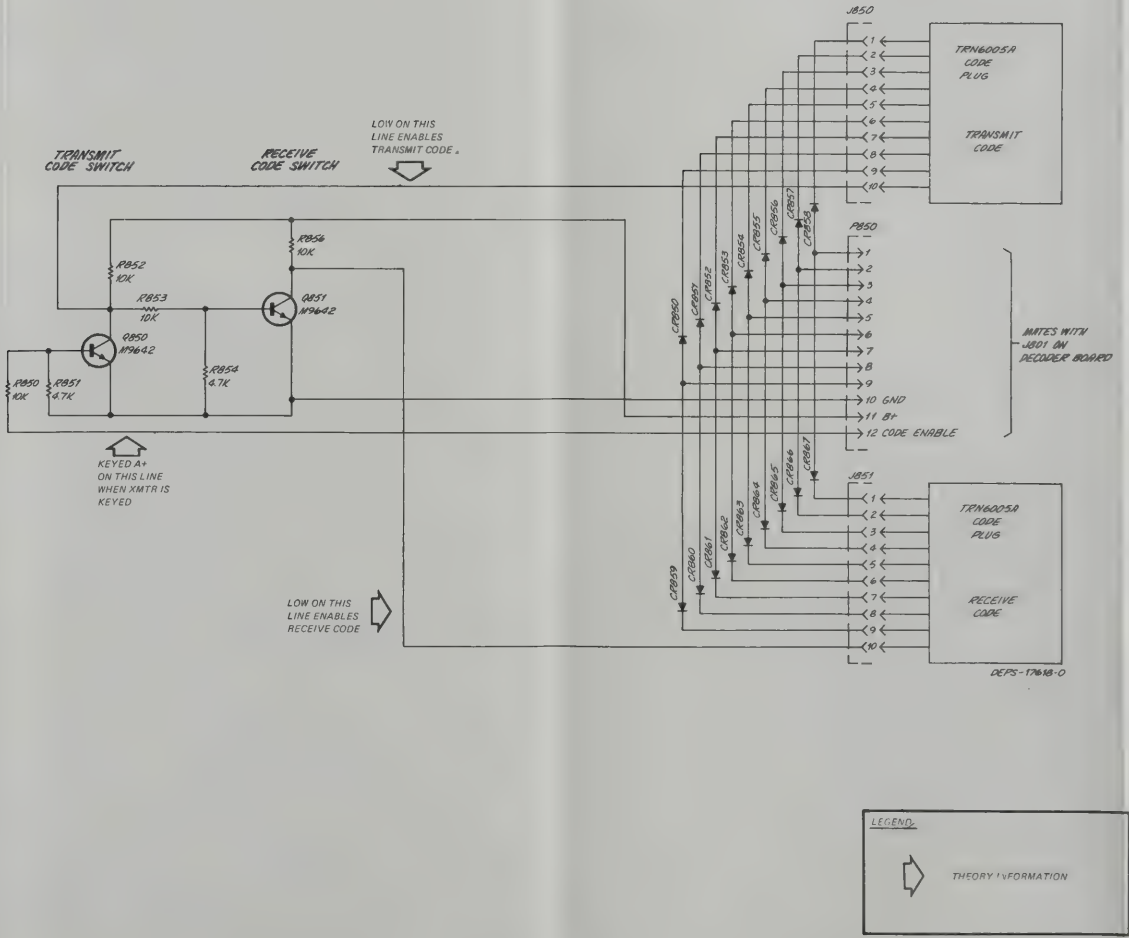
APPLICATION —

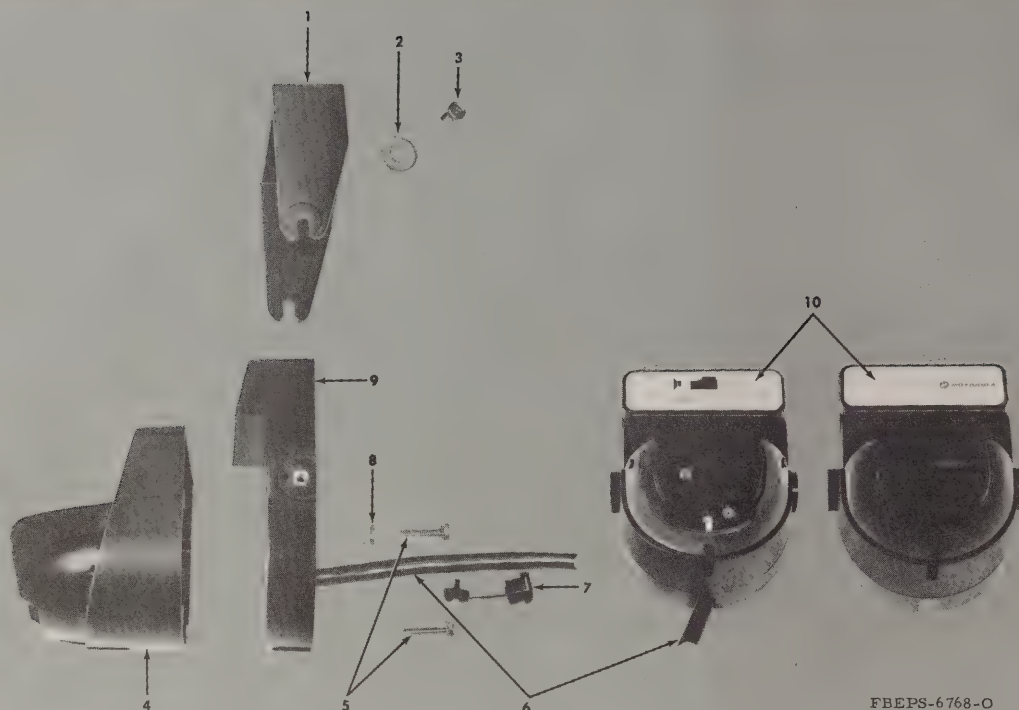
Plugs into code plug receptacle on “Digital Private-Line” decoder or encoder-decoder to allow separate “Digital Private-Line” codes for transmit and receive. Code plugs for the two codes then plug into the receptacles on the two-code adapter board.

parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR850 – 867	48-83654H01	diode (see note): silicon
J850, 851	9-82071K01	connector, receptacle: female, 12-contact
P850	28-82070K01	connector, plug: consists of CONTACT, male; 13 req'd
Q850, 851	48-869642	transistor (see note): NPN; type M9642
R850, 852, 853, 856	6-124A73	resistor, fixed: 10k \pm 5%; 1/4 W
R851, 854	6-124A65	4.7k \pm 5%; 1/4 W
non-referenced items		
1V80769B88		CIRCUIT BOARD ASSY., incl. referenced item P850
3-138804		SCREW, machine (4-40 x 1/4"); 2 req'd

note: For best performance, order diodes and transistors by Motorola part number.





HANDSET HANGUP BOX

Handset hangup boxes are used (1) to automatically switch the radio from "Monitor (carrier squelch) mode" to "Digital Private-Line" mode when the handset is off-hook, and (2) transfer audio from the handset speaker to the handset receiver when the handset is off-hook. Model TLN4698A is used in most installations. Model TLN4507A also contains a slide switch to place the radio in the monitor mode with the handset still on-hook; this model is used in situations where the normal MONITOR switch on the control panel is used for special functions, or when used in conjunction with a carrier squelch control head. The Handset Hangup Cup is supplied with carrier squelch

parts list

Hangup Boxes

PL-6063-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	7D80200E01	trunnion bracket
2	4S1724	flat washer (0.234" x 0.625" x .048")
3	3S7302	Phillips hexhead machine screw (10-32 x 3/8")
4	15C84520C01 or 15C84520C02	hangup cup and switch assembly hangup cup (TLN4505A)
5	3S135507	Phillips hexhead machine screw (6-32 x 3/4")
6	1V80717B42 or 1V80727B32	cable assembly, includes attached insertable connector contacts (TLN4507A) cable assembly, includes attached insertable connector contacts (TLN4698A)
7	42B82018H08	cable strain relief anchor
8	4S1720	flat washer (0.156" x 0.378" x .030")
9	1V80717B40 or 58D84514C01	mounting base and switch assembly (TLN4507A) mounting base (TLN4698A and TLN4505A)
10	13B84515C01 or 13B84515C02	escutcheon (TLN4507A) escutcheon (TLN4698A and TLN4505A)
non-coded items		
	42B82018H08	cable retainer (TLN4698A)
	3S136756	tapping screw (20 x 3/8") (TLN4698A)
	38B84383D01	protective cap

parts list

HSN4002A Speaker (with Systems 90)

PL-7223-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
LS301	50-84561B02	speaker diameter 5", PM
mechanical parts		
	18-0701T24	cable
	18-0705T21	mounting hardware
	3-140001	tapping screw (6-19 x 7/8"), 4 used
	38-4244C01	wing screw, 2 used
	78-4568B01	trunnion bracket
	13-82671M01	speaker bezel
	15-84981B01	speaker base cover
	32-84564B01	speaker gasket



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**Communications
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instruction manual revision

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct your manual accordingly.

INSTRUCTION MANUAL AFFECTED:

68P81045E70-O MITREK Two-Way FM Radio, 146-174 MHz, 40/60/75/110 W

REVISION DETAILS:

1. In Instruction Section **68P81039E29-C** (Sheet 3 of 5), on the lower right side of the PC board, locate U201, draw a capacitor connected to Pin 10 and Pins 4 and 5, and write C241 beside the capacitor.
2. In Instruction Section **68P81039E29-C** (Sheet 3 of 5), Parts List PL-6056-D, the first column, toward the bottom of the parts list, locate "C240." Between "C240" and "C412" draw an arrow and add C241 21-82240K06 220 \pm 10% ;100 V.
3. In Instruction Section **68P81039E29-C** (Sheet 4 of 5), on the top right of Diagram EEPS-26056-C, locate U201, draw a capacitor between Pin 10 and ground, and write "C241" and "220 pf" beside the capacitor.

1 of 1

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WMR-0043
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“MITREK” ACCESSORIES

MOBILE MICROPHONE

The mobile microphone contains the microphone element and a push-to-talk switch. Model HMN4000B is packaged in a rugged weather-resistant housing; Model HMN4001B uses conventional packaging. Schematic details are shown on the control head schematic diagram in this manual.

parts list

HMN4005A Microphone		PLW-0036-C
HMN4006A Microphone		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P102	1-84135C01	cable assembly includes coil cord
MK321	1-80706T87	cartridge ELECTRETBOARD, preamp coated
S318	40-82263G01	switch dpst
mechanical parts		
	3-13999	tapping screw (6-32 x 3/4"), 3 used
	3-14000	tapping screw (6-32 x 3/4"), 3 used
	3-135084	screw, 2 used
	13-83174B03	microphone front housing
	15-82662M24	microphone gasket
	35-82652K01	microphone baffle
	38-84559B01	microphone button
	*42-852710	strap
	1-80701T27	microphone rear housing, includes hangup button
	33-82599D07	nameplate (HMN4005A, 4006A)
	54-84962K01	safety tag
	15-82896M01	microphone adapter
	29-5355	lug
	37-12706	grommet
	4-136334	flat washer

note: The conformal coating on the electret preamp circuit board must remain undisturbed. The board cannot be repaired.

SPEAKER

The HSN4000A Speaker provides the audio output from the radio. It is equipped with its own trunnion bracket and may be mounted on the firewall or dashboard near the radio. The speaker is mounted in a strong, weather-resistant housing.

parts list

HSN4000A Speaker		PL-6060-D
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
LS301	50-84561B02	speaker diameter 5", PM
mechanical parts		
	3-132436	machine screw (6-32 x 1 1/4"), 4 used
	3-84244C01	trunnion screw, 2 used
	7-80200E02	trunnion bracket
	13-84151C02	speaker bezel
	15-84981B09	speaker base cover
	32-80195A01	speaker gasket
	38-84383D02	protective cap, 3 used
	29-82602D01	terminal pin, 2 used
	37-82603D31	sleeving, coded 31
	37-82603D32	sleeving, coded 32
	42-82018H05	cable retainer
	42-84081A03	wire clamp
	3-136756	tapping screw (10-16 x 3/4"), 3 used
	30-83155H01	2-conductor cable

MICROPHONE HANGUP BOX

The microphone hangup boxes are used with "Private-Line" and "Digital Private-Line" radios to automatically place the radios in the monitor (carrier-squelch) mode when the microphone is lifted off-hook. Model HLN4024A is used in most installations. Model HLN4025A also contains a slide switch to place the radio in the monitor mode with the microphone still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions or when used in conjunction with a carrier squelch control head.

parts list

HLN4024A Microphone Hangup Box		PL-6061-D
HLN4025A Microphone Hangup Box with Switch		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S101	40-82159D02 or 40-84198C02	switch spst open leaf (HLN4025A)
S301	40-84622B04	spst, slide (HLN4025A)
mechanical parts		
	3-139913	tapping screw (8-15 x 1/4"), 2 used
	3-129075	machine screw (2-56 x 1/2"), 2 used (HLN4024A)
	4-8406	#2 internal lockwasher, 2 used
	7-80268A01	switch bracket (HLN4024A)
	14-80266A01	insulator (HLN4024A)
	32-05719B01	switch boot (HLN4024A)
	38-84383D01	protective cap, 2 used
	42-82018H07	cable retainer
	15-80191A01	hangup box housing
	4-400136	flat washer (.196 x .312 x .067")
	41-867668	spring
	29-82602D01	terminal pin, 2 used
	37-80143B01	coded 24/30 sleeving
	37-82603D27	coded 27 sleeving
	3-135495	tapping screw (2-56 x 3/4"), 2 used (HLN4025A)
	64-84199C01	mounting plate (HLN4025A)
	15-84626B02	hangup box housing (HLN4025A)
	2-7041	nut (2-56 x 3/4"), 2 used (HLN4024A)
	64-80240E01	pressure plate switch

IGNITION SENSE LEAD

The optional ignition sense lead is used in systems where the green lead is connected to the battery (allowing receiver operation at all times) and it is desired to allow transmitter operation *only* when the ignition switch is on. This option includes the orange power lead and fuse; this lead supplies power to the radio PTT circuits when an optional jumper is altered in dc control head.

parts list

HKM4007A Ignition Switch Cable		PL-6056-B
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F401	65-890033	fuse: 1-1/2 amp; 250 V
		fuseholder: includes: 14-82882A01 INSULATOR, fuse, body 14-82883A01 INSULATOR, fuse, cap 41-82885A01 SPRING 42-82884A01 CLIP, fuse; 2 used
	30-10310A62	cable, power, orange, includes:
	37-82603D20	WIRE, 16 ga. stranded, orange, 66-1/2"
	29-82602D01	SLEEVING, coded #20
	29-136968	PIN TERMINAL
	29-824456	LUG, soldering
	29-865065	LUG, ring tongue
		LUG, ring tongue

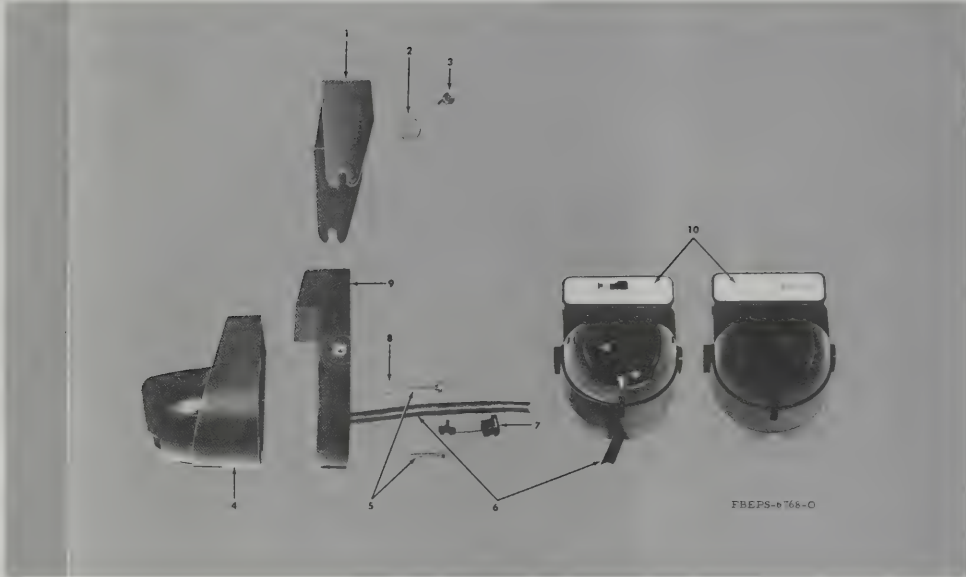
HANDSET

The TMN6057A Handset is used in installations where a telephone-style handset is preferred to the mobile microphone and speaker. The unit operates in the same manner as a telephone handset except that it has a PTT button which is used to key the radio.

parts list

TMN6057A HANDSET		PL-6064-A	
CODE	MOTOROLA PART NO.	DESCRIPTION	
1	15B84054A01	CAP, receiver (see note)	
2	58C84058A01	CARTRIDGE, receiver	
3	15C84059A01	HANDLE (see note)	
4	3S124432	SCREW, machine: 4-40 x 1/4" "Phillips" flat head; 2 req'd.	
5	40C84087A01	SWITCH, push; includes pushbutton and dust cover	
6	15B84053A01	PLATE, switch cover	
7	15B84055A01	CAP, transmitter (see note)	
8	59B83272G01	MICROPHONE ELEMENT, telephone; dynamic type	
9	7B83352H01	BRACKET, cord retaining	
10	1D84519C01	CORD ASSEMBLY; includes a "molded-on" 5-contact female connector	
12		CONNECTOR, plug; 5-contact; "molded-on"	

note: A replacement handle, plus transmit and receiver caps, can be obtained by ordering Part No. 15C84107A01.



HANDSET HANGUP BOX

The handset hangup boxes are used (1) to automatically place "Private-Line" and "Digital Private-Line" radios in the monitor (carrier squelch) mode when the handset is lifted off-hook, and (2) transfer audio from the mobile speaker to the handset receiver when the handset is lifted off-hook. Model TLN4698A is used in most installations. Model TLN4507A also contains a slide switch to place the radio in the monitor mode with the handset still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions, or when used in conjunction with a carrier squelch control head. The TLN4505A Handset Hangup Cup is supplied with carrier squelch models.

parts list

Hangup Boxes			PL-6063-B
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
1	7D80200E01	trunnion bracket	
2	451724	flat washer (0.234" x 0.625" x .048")	
3	3S7302	Phillips hexhead machine screw (10-32 x 3/4")	
4	15C84520C01 or 15C84520C02	hangup cup and switch assembly	
5	3S135507	Phillips hexhead machine screw (6-32 x 3/4")	
6	1V80717B42 or 1V80727B32	cable assembly, includes attached insertable connector contacts (TLN4507A)	
7	42B82018H08	cable strain relief anchor	
8	451720	flat washer (0.156" x 0.378" x .030")	
9	1V80717B40	mounting base and switch assembly (TLN4507A)	
10	or 58D84514C01 13B84515C01 or 13B84515C02	mounting base (TLN4698A and TLN4505A) escutcheon (TLN4507A) escutcheon (TLN4698A and TLN4505A)	
non-coded items			
	42B82018H08	cable retainer (TLN4698A)	
	3S136756	tapping screw (20 x 3/4") (TLN4698A)	
	38B84383D01	protective cap	

parts list

HSN4002A Speaker (with Systems 90)		PL-7223-C
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
LS301	50-84561B02	speaker diameter 5", PM
mechanical parts		
	18-0701T24	cable
	18-0705T21	mounting hardware
	3-140001	tapping screw (6-19 x 3/4"), 4 used
	38-4244C01	wing screw, 2 used
	78-4568B01	trunnion bracket
	13-82671M01	speaker bezel
	15-84981B01	speaker base cover
	32-84564B01	speaker gasket



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instruction manual revision

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct your manual accordingly.

INSTRUCTION MANUAL AFFECTED:

68P81045E70-O MITREK Two-Way FM Radio, 146-174 MHz, 40/60/75/110 W

REVISION DETAILS:

1. In Instruction Section **68P81039E29-C** (Sheet 3 of 5), on the lower right side of the PC board, locate U201, draw a capacitor connected to Pin 10 and Pins 4 and 5, and write C241 beside the capacitor.
2. In Instruction Section **68P81039E29-C** (Sheet 3 of 5), Parts List PL-6056-D, the first column, toward the bottom of the parts list, locate "C240." Between "C240" and "C412" draw an arrow and add C241 21-82240K06 220 $\pm 10\%$;100 V.
3. In Instruction Section **68P81039E29-C** (Sheet 4 of 5), on the top right of Diagram EEPS-26056-C, locate U201, draw a capacitor between Pin 10 and ground, and write "C241" and "220 pF" beside the capacitor.

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WMR-0043
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instruction manual revision

Supersedes WMR-0053 and SMR-4277

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This revision consists of changes that have occurred since your instruction manual was printed. Please correct your manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E70-O MITREK Two-Way FM Radio, 136-174 MHz 40/60/75/110 W

REVISION DETAILS:

1. Please add the attached table of contents and pages ii, iii, and iv to your manual and delete the present table of contents and pages ii, iii, and iv.
2. Please add attached Instruction Sections PEPS-26663-C and PEPS-26662-F, the functional block diagram (EEPS-29956-B) page 7, and 68P81039E29-D (Sheet 1 of 5) to your manual and delete Instruction Sections PEPS-26663-C and PEPS-26662-E, the functional block diagram (EEPS-29956-A) page 7, and 68P81039E29-C (Sheet 1 of 5).
3. Please add attached Instruction Sections 68P80200W06-O and 68P81039E23-G to your manual and delete Instruction Sections 68P81039E22-C and 68P81039E23-C.

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MITREK TWO-WAY FM RADIO

**136-174 MHz
40/60/75/110 WATTS**

<i>SECTION</i>	<i>NUMBER</i>
OPERATION	Inside Cover
Radio Set Model Chart	Page iii
Unified Chassis Breakdown	Page iii, iv
PA Breakdown and Options Chart	Page v
Specifications	Page vi
Foreword	Pages vii, viii
GENERAL SAFETY INFORMATION	68P81045E71
INSTALLATION	6P81109E32
Installation Considerations	(Sheet 1 of 2)
Installation Procedures	(Sheet 2 of 2)
THEORY OF OPERATION	Page 1
General	Page 1
Meter 4 Circuit	Page 1
Power Control and Protection Circuit	Page 1
Bridge Audio Circuit	Page 2
MAINTENANCE	Page 3
General	Page 3
Radio Set Disassembly	Page 3
Power Amplifier	Page 4
High Power PA Field Repair Failure Analysis	Page 4
Ignition Noise and Anti-Skid Braking	Page 4
ALIGNMENT	
Test Equipment and Receiver Alignment	PEPS-26663
Transmitter Alignment	PEPS-26662
INSTRUCTION SECTIONS	
Functional Block Diagram	Page 7
Transmitter Section and Time-Out Timer Parts Lists and Circuit Board Details	68P81039E29 (Sheet 1 of 5)
Transmitter Section Schematic Diagram	68P81039E29 (Sheet 2 of 5)
Receiver Section, Busy Light, and Interconnect Board Circuit Board Details	68P81039E29 (Sheet 3 of 5)
Receiver Section, Busy Light, and Interconnect Board Schematic Diagrams	68P81039E29 (Sheet 4 of 5)
Radio Set Mechanical Parts	68P81039E29 (Sheet 5 of 5)
Lock Removal Procedure	68P81039E29 (Sheet 5 of 5)
40 Watt Power Amplifier, Instruction Section	68P81039E31
60 Watt Power Amplifier, Instruction Section	68P81039E32
75 or 110 Watt Power Amplifier	68P81040E53

*SECTION**NUMBER*

HLN4181A Solid State "Private-Line" Encoder-Decoder, Instruction Section	68P80200W06
HLN4011A Digital "Private-Line" Encoder-Decoder, Instruction Section	68P81039E23
TLN5730A Digital "Private-Line" Two-Code Adapter, Instruction Section	68P81106E97
<i>MITREK</i> Accessories, Instruction Section	68P81039E26
<i>MITREK</i> Control Head and Cables, Instruction Section	68P81039E24

MODEL CHART

FOR

146-174 MHz

MITREK MOBILE RADIO

1-4 FREQUENCY

40, 60, 75 AND 110 W RF POWER

LEGEND:

- = ONE ITEM SUPPLIED
- = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- 4 = NUMBER INDICATES QUANTITY SUPPLIED
- = INDICATES BREAKDOWN ON SEPARATE CHART

MODEL NUMBER	DESCRIPTION	RF OUTPUT	FREQ.
T43JJA1000BK	RADIO SET	40 WATT	1
T43JJA1900BK	RADIO SET	40 WATT	4
T53JJA1000BK	RADIO SET	60 WATT	1
T53JJA1900BK	RADIO SET	60 WATT	4
T63JJA1000BK	RADIO SET	75 WATT	1
T63JJA1900BK	RADIO SET	75 WATT	4
T83JJA1000BK	RADIO SET	110 WATT	1
T83JJA1900BK	RADIO SET	110 WATT	4
"PRIVATE LINE"			
T43JJA3000CK	RADIO SET	40 WATT	1
T43JJA3900CK	RADIO SET	40 WATT	4
T53JJA3000CK	RADIO SET	60 WATT	1
T53JJA3900CK	RADIO SET	60 WATT	4
T63JJA3000CK	RADIO SET	75 WATT	1
T63JJA3900CK	RADIO SET	75 WATT	4
T83JJA3000CK	RADIO SET	110 WATT	1
T83JJA3900CK	RADIO SET	110 WATT	4
"DIGITAL PRIVATE-LINE"			
T43JJA6000BK	RADIO SET	40 WATT	1
T43JJA6900BK	RADIO SET	40 WATT	4
T53JJA6000BK	RADIO SET	60 WATT	1
T53JJA6900BK	RADIO SET	60 WATT	4
T63JJA6000BK	RADIO SET	75 WATT	1
T63JJA6900BK	RADIO SET	75 WATT	4
T83JJA6000BK	RADIO SET	110 WATT	1
T83JJA6900BK	RADIO SET	110 WATT	4

ITEM	DESCRIPTION
■ HUD1001B	CHASSIS, 136-146 MHz (40 WATT)
■ HUD1002B	CHASSIS, 146-174 MHz (40 WATT)
■ HUD1011B	CHASSIS, 136-146 MHz (60 WATT)
■ HUD1012B	CHASSIS, 146-174 MHz (60 WATT)
■ HUD1031B	CHASSIS, 136-146 MHz (75/110 WATT)
■ HUD1032B	CHASSIS, 146-174 MHz (75/110 WATT)
HLN4181A	"PRIVATE-LINE" BOARD
HLN4011A	"DIGITAL PRIVATE-LINE" BOARD
TRN6005A	CODE PLUG
TRN4224A	CODE PLUG
KXN1086B	CHANNEL ELEMENT, RECEIVER
KXN1088A	CHANNEL ELEMENT, TRANSMITTER
HHN4000A	HOUSING, TOP COVER LOW POWER
HHN4001A	HOUSING, TOP COVER HIGH POWER
HLN4034A	HOUSING, BOTTOM COVER
HCN4000A	CONTROL HEAD, 1-FREQ., CARRIER SQUELCH
HCN4001A	CONTROL HEAD, 4-FREQ., CARRIER SQUELCH
HCN4002A	CONTROL HEAD, 1-FREQ., "PRIVATE-LINE"
HCN4003A	CONTROL HEAD, 4-FREQ., "PRIVATE-LINE"
HMN4000A	MICROPHONE
HSN4000A	SPEAKER
HKN4000A	CABLE (17') 1-FREQ.
HKN4001A	CABLE (17') 4-FREQ.
HKN4016A	CABLE (17') 1-FREQ.
HKN4017A	CABLE (17') 4-FREQ.
HLN4024A	MICROPHONE HANG-UP BOX
TAD6111A	ANTENNA, ROOF TOP (136-144 MHz)
TAD6112A	ANTENNA, ROOF TOP (144-152 MHz)
TAD6113A	ANTENNA, ROOF TOP (152-162 MHz)
TAD6014A	ANTENNA, ROOF TOP (162-174 MHz)
HLN4022A	INSTALLATION KIT
HLN4023A	TUNING TOOL KIT
HKN4041A	FUSE LEAD

EPS-27385-B

MITREK MOBILE RADIO

136-174 MHz

40, 60, 75 AND 110 WATT

RF POWER

LEGEND:

- = ONE ITEM SUPPLIED
- = SEE FURTHER BREAKDOWN IN THIS CHART
- ★ = SEE FURTHER BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION
■ HUD1001B	UNIFIED CHASSIS, 136-146 MHz (40 WATT) R1
■ HUD1002B	UNIFIED CHASSIS, 146-174 MHz (40 WATT) R2
■ HUD1011A	UNIFIED CHASSIS, (60 WATT) R1
■ HUD1012B	UNIFIED CHASSIS (60 WATT) R2
■ HUD1031B	UNIFIED CHASSIS (110 WATT) R1
■ HUD1032B	UNIFIED CHASSIS (110 WATT) R2
HUD1003B	UNIFIED SUB CHASSIS
HUD1004B	UNIFIED SUB CHASSIS
HUD1013B	UNIFIED SUB CHASSIS
HUD1014B	UNIFIED SUB CHASSIS
HUD1033B	UNIFIED SUB CHASSIS
HUD1034B	UNIFIED SUB CHASSIS

MODEL	DESCRIPTION
■ HUD1003B	UNIFIED CHASSIS, VHF R1 (40 WATT)
■ HUD1004B	UNIFIED CHASSIS, VHF R2 (40 WATT)
■ HUD1013B	UNIFIED CHASSIS, VHF R1 (60 WATT)
■ HUD1014B	UNIFIED CHASSIS, VHF R2 (60 WATT)
■ HUD1033B	UNIFIED CHASSIS, VHF R1 (110 WATT)
■ HUD1034B	UNIFIED CHASSIS, VHF R2 (110 WATT)
HLN4189A	HARDWARE KIT, 136-174 MHz
★ HLD1001A	POWER AMPLIFIER, R1 (40 WATT)
★ HLD1002A	POWER AMPLIFIER, R2 (40 WATT)
★ HLD1011A	POWER AMPLIFIER, R1 (60 WATT)
★ HLD1012A	POWER AMPLIFIER, R2 (60 WATT)
★ HLD1031A	POWER AMPLIFIER, R1 (110 WATT)
★ HLD1032A	POWER AMPLIFIER, R2 (110 WATT)
HLD4001B	MAIN BOARD, R1
HLD4002B	MAIN BOARD, R2
HLD4001C	MAIN BOARD, R1
HLN4014A	HARDWARE KIT
HLN4019A	HARDWARE WIRING KIT
HLN4037A	HARDWARE KIT, HI-POWER
HLN4047A	HARDWARE WIRING KIT, HI-POWER
HLN4033A	BOTTOM COVER INNER & GASKET
HLN4044A	BOARD INTERCONNECT

EPS-29766-0

HIGH BAND MITREK

RECEIVER ALIGNMENT AND TEST EQUIPMENT LIST

GENERAL	L RF MODULE
AC-DC VOM	
DC Multimeter	L2
AC Voltmeter	L1
RF Voltmeter	
Oscilloscope	
RF Wattmeter	L114
Frequency Meter	
Deviation Meter	
RF Signal Generator	
Audio Signal Generator	R4 WARP
PL Tone Generator	METER 4 PINS
	FAEPS-26352-A

Receiver Alignment Locations

DPL Test Set**
Radio Test Set appropriate meter SKN6012B
Tuning Tool Kit
DC Power Supply
*Required for test
**Required for test

Version

In position
Set are
necessar

MITREK MOBILE RADIO

136-174 MHz

40, 60, 75 AND 110 WATT

RF POWER

LEGEND:

- = ONE ITEM SUPPLIED
- = SEE FURTHER BREAKDOWN IN THIS CHART
- ★ = SEE FURTHER BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION
■ HUD1001B	UNIFIED CHASSIS, 136-146 MHz (40 WATT) R1
■ HUD1002B	UNIFIED CHASSIS, 146-174 MHz (40 WATT) R2
■ HUD1011A	UNIFIED CHASSIS, (60 WATT) R1
■ HUD1012B	UNIFIED CHASSIS (60 WATT) R2
■ HUD1031B	UNIFIED CHASSIS, (110 WATT) R1
■ HUD1032B	UNIFIED CHASSIS (110 WATT) R2
HUD1003B	UNIFIED SUB CHASSIS
HUD1004B	UNIFIED SUB CHASSIS
HUD1013B	UNIFIED SUB CHASSIS
HUD1014B	UNIFIED SUB CHASSIS
HUD1033B	UNIFIED SUB CHASSIS
HUD1034B	UNIFIED SUB CHASSIS

MODEL	DESCRIPTION
■ HUD1003B	UNIFIED CHASSIS, VHF R1 (40 WATT)
■ HUD1004B	UNIFIED CHASSIS, VHF R2 (40 WATT)
■ HUD1013B	UNIFIED CHASSIS, VHF R1 (60 WATT)
■ HUD1014B	UNIFIED CHASSIS, VHF R2 (60 WATT)
■ HUD1033B	UNIFIED CHASSIS, VHF R1 (110 WATT)
■ HUD1034B	UNIFIED CHASSIS, VHF R2 (110 WATT)
HLN4189A	HARDWARE KIT, 136-174 MHz
★ HLD1001A	POWER AMPLIFIER, R1 (40 WATT)
★ HLD1002A	POWER AMPLIFIER, R2 (40 WATT)
★ HLD1011A	POWER AMPLIFIER, R1 (60 WATT)
★ HLD1012A	POWER AMPLIFIER, R2 (60 WATT)
★ HLD1031A	POWER AMPLIFIER, R1 (110 WATT)
★ HLD1032A	POWER AMPLIFIER, R2 (110 WATT)
HLD4001B	MAIN BOARD, R1
HLD4002B	MAIN BOARD, R2
HLD4001C	MAIN BOARD, R1
HLN4014A	HARDWARE KIT
HLN4019A	HARDWARE WIRING KIT
HLN4037A	HARDWARE KIT, HI-POWER
HLN4047A	HARDWARE WIRING KIT, HI-POWER
HLN4033A	BOTTOM COVER INNER & GASKET
HLN4044A	BOARD INTERCONNECT

EPS-29766-O

REQUIRED TEST EQUIPMENT FOR MITREK RADIO SERVICING			
GENERAL TYPE	APPLICATION	RECOMMENDED MODEL	MINIMUM SPECIFICATIONS
AC-DC VOM	DC voltage measurements, general	Motorola T1009A	Measurement range: 0-15 V dc Sensitivity: 20,000 ohms/volt
DC Multimeter	DC voltage readings requiring a high input resistance meter.	Motorola S1063B	Measurement range: 0-15 V dc Input resistance: 11 megohms
AC Voltmeter	Audio voltage measurements	Motorola S1053C	Measurement range: 0-10 V ac Input resistance: 10 megohms
RF Voltmeter	RF voltage measurements	Motorola S1339A	Measurement range: 100 uV-3 V from 1 MHz-512 MHz Inputs: 50 ohm and high impedance
Oscilloscope	Waveform observation	Motorola R1004A	Vertical sensitivity: 5 mV - 10 V/division Horizontal time base: 0.2 usec. 0.5 sec/division
RF Wattmeter	Transmitter output power measurement	Motorola S1350A with appropriate element and T1013A RF Dummy Load	Measurement range: 0-100 Watts
Frequency Meter	Transmitter frequency measurement	Model R1200A Service Monitor with high stability oscillator (X suffix) option. Frequency calibration recommended every 6 months or less.	Measurement range: 134-174 MHz Frequency resolution: 10 Hz
Deviation Meter	Transmitter modulation deviation measurement	Motorola R1200A Service Monitor	Measurement range: 0-10 kHz deviation Frequency range: 134-174 MHz
RF Signal Generator	Receiver Alignment and troubleshooting	Motorola R1200A Service Monitor with attenuator	Frequency range: 134-174 MHz Output Level: 0.1 uV-100,000 uV Must be capable of at least ± 3 kHz deviation when modulated by 1 kHz tone.
Audio Signal Generator	Audio Circuit troubleshooting	Motorola S1067B	Frequency range: 20 Hz-20 kHz Output Level: 50 mV-1 V
PL Tone Generator*	Tone-Coded "Private-Line" Decoder Troubleshooting	Motorola S1333B	Frequency range: 10 Hz-9999 Hz Output Level: 0-3 V rms
DPL Test Set**	"Digital Private-Line" Encoder-Decoder Troubleshooting	Motorola SLN6413A	
Radio Test Set w/appropriate metering cable SKN6012B	Meter readings at circuit metering points for alignment and troubleshooting	Motorola S1056B Portable Test Set, TEK5B-E Metering Panel with RPX4053A Conversion Kit, or TEK5F Metering Panel.	
Tuning Tool Kit	Receiver and transmitter alignment	Motorola HLN4023A	
DC Power Supply	DC power for shop service	Motorola R1011AA	1-20 V DC 0-40 A

*Required for tone-coded "Private-Line" models only
**Required for "Digital Private-Line" models only

NOTE

Versions B-E of TEK5 Metering Panel must be modified with RPX4053A Conversion Kit before use with MITREK radio.

FREQUENCY CALCULATIONS

FREQUENCY (MHz)	CALCULATION
136-174	$f_o = \frac{f_c - 10.7}{3}$

Where f_o = crystal frequency, f_c = carrier frequency

POSITIVE GROUND SYSTEMS — CAUTION:

In positive ground systems the case of the TEK5 Meter Panel and portions of the S1056B Portable Test Set are hot with respect to the vehicle chassis due to the nature of the positive ground installation. Take necessary precautions that the test equipment does not contact the vehicle chassis.

VHF MITREK RECEIVER ALIGNMENT PROCEDURE

1. The tuning procedure should be performed using the Motorola portable test set or the TEK5 set to position A. If using the TEK5-F or modified TEK5-B through TEK5-E meter panels, put the M1, 2 polarity switch in the reverse position and ignore the indicated polarity notes.

2. IMPORTANT: When using the Motorola portable test set for M4 place the FUNCTION SELECTOR SWITCH to the XMTR position. Switch polarity as necessary for proper M4 operation.

STEP	TEST SET METER POSITION	ADJUST	PROCEDURE
1		L1-L5	Preset the RF preselector tuning screws per the preset chart.
2		L109, L111, L114	Preset the injection string coil slugs per the preset chart.
3		L106	Preset the mixer gate coil per the preset chart. <i>This is the only tuning performed on this coil. Preset carefully.</i>
4		L107	Preset mixer drain coil slug 10 turns from flush with top of coil form.
5		L204, L206	Preset the i-f matching network coil slugs 8 turns from flush with top of coil form.
6	2 (Reverse)	L208	Starting with the slug flush with top of coil form, adjust the detector coil for the <i>first</i> reading of 24 uA on meter 2. (No input signal is necessary). Perform Step 7A for radios with maximum receive frequency separation of 0.5 MHz or less; perform Step 7B for radios with maximum receive frequency separation greater than 0.5 MHz.
7A	6	L109, L111, L114	Adjust the injection string coils for peak reading on meter 6 with the <i>lowest</i> frequency selected. Repeat until no further improvement is obtained.
7B	6	L109, L111, L114	Adjust the injection string coils for peak reading on meter 6 with the <i>highest</i> frequency selected. Repeat until no further improvement is obtained. Tune L109 for peak meter 6 reading with the <i>lowest</i> frequency selected. Repeat L114 and L111 for peak on <i>highest</i> frequency and L109 on <i>lowest</i> frequency until no further improvement is obtained.
8	1 (Reverse), 4	Receiver Oscillator Warp	For each frequency, set rf generator to the carrier frequency (± 100 Hz) and adjust the output level for a meter 1 reading of 35 uA. Activate the meter 4 circuit by shorting the meter 4 enable pins. Adjust oscillator frequency for a zero reading on meter 4.
9	1 (Reverse)	L1-5 (and L153 with Preamp)	Adjust L1, L2, (L153), L3, L4, L5 in order for peak reading on meter 1 using the <i>highest</i> frequency and maintaining meter 1 between 30 and 40 uA by adjusting the signal generator output. Repeat until no further improvement is obtained. Perform Step 10 <i>only</i> for radios with maximum receive frequency separation greater than 0.5 MHz.
10	1 (Reverse)	L1-L5 (and L153 with preamp)	Adjust L1, L2, (L153), L3, L4, L5 once in that order for peak reading on meter 1 using the <i>lowest</i> frequency and maintaining meter 1 between 30 uA and 40 uA by adjusting the signal generator output.
11	1 (Reverse)	L107, L204, L206	Apply standard test modulation (1 kHz tone, ± 3 kHz deviation) to the rf signal generator and adjust the output level for 35 uA on meter 1. Adjust i-f coils for a peak reading on meter 1 while maintaining meter 1 between 30 uA and 40 uA by adjusting the generator output. Repeat until no further improvement is obtained.
12	7 (AC Voltmeter across the speaker)	L208	With the same conditions as in Step 11, adjust L208 <i>slowly</i> for maximum audio voltage across the speaker.
13	1 (Reverse), 4	Receiver Oscillator Warp	Repeat Step 8.
14A	AC Voltmeter across speaker	L5 (or L1, L2 with Preamp)	Perform Step 14A for radios with maximum receive frequency separation of 0.5 MHz or less; perform Step 14B for radios with maximum receive frequency separation greater than 0.5 MHz.
14B	AC Voltmeter across Speaker	L1-L5 (Do not adjust L153 in preamp radios)	Adjust L5 (or L1 and L2 in Preamp Radios) for best quieting with the highest frequency selected. Receiver tuning is now complete.
			Check 20 dB quieting sensitivity on all frequencies. <i>If necessary</i> , retune L1 and L2 <i>once</i> on highest frequency for best quieting. Check sensitivities again and <i>if necessary</i> retune L3-5 <i>once</i> , on the lowest frequency, for best quieting. Tuning is complete.

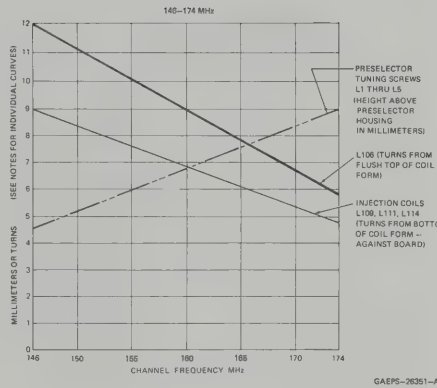
RECEIVER METERING TABLES

1. Meter readings reflect no signal applied after proper alignment.

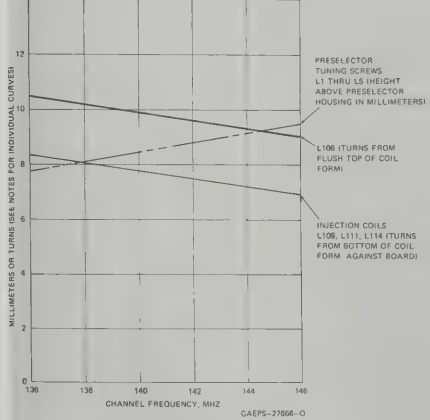
2. When dial readings are shown the reading before the / is without preamplifier and the reading after the / is with preamplifier.

PORTABLE TEST SET SWITCH POSITION	1	2	4	6
METER READING (uA)	12/14 (min) 30/32 (max)	20 (min) 28 (max)	0 (nom)	10 (min)
FUNCTION METERED	Signal Strength	Detector D.C. Output	Carrier Offset	Injection Level

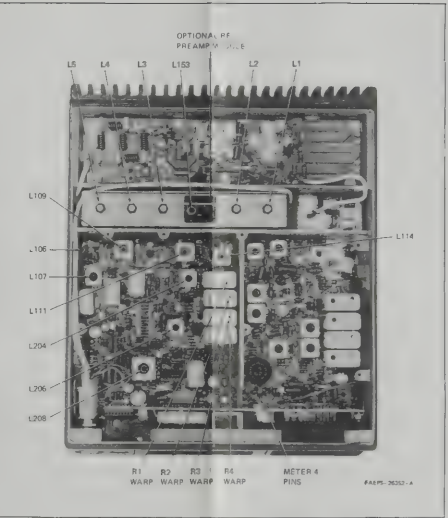
146-174 MHz



136-146 MHz



Receiver Preset Charts



High Band MITREK Receiver Alignment Locations

HIGH BAND MITREK RECEIVER ALIGNMENT AND TEST EQUIPMENT LIST

DEVIATION ADJUSTMENT

The oscillator frequency adjustment must be made *before* this adjustment.

Step 1: Connect the output leads of the tone oscillator through a 0.33- μ F capacitor to the transmitter audio input (microphone receptacle).

Step 2: Connect the ac voltmeter across the audio oscillator and adjust the tone generator output to 1 volt at 1000 Hz. On Private-Line radios disable the encoder by turning R23 on the PL board fully counterclockwise. On Digital Private-Line radios short the code disable points.

Step 3: Switch the frequency selector switch to F1 and key the transmitter. Adjust F1 DEV ADJ for:

Carrier Squelch Radio	4.8 kHz
PL/DPL Radio	4.0 kHz

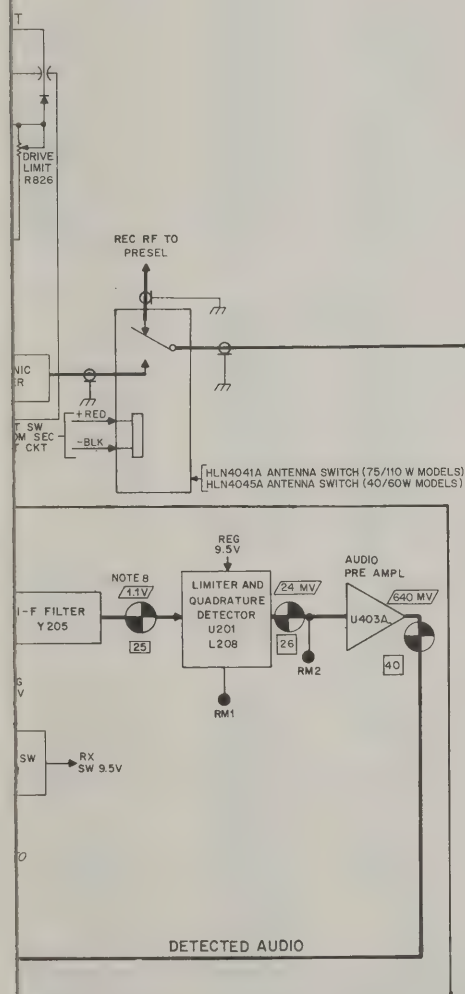
For multiple-frequency models, adjust the F2, F3, and F4 deviation with the frequency selector switch in the corresponding position. This completes the deviation adjustment for carrier squelch radios.

Step 4: For Private-Line or Digital Private-Line radios, disconnect the audio oscillator. On Private-Line radios adjust R23 on the PL board to set PL DEV to 700 Hz. No deviation adjustment is required for DPL radios. Private-Line or Digital Private-Line deviation should read 750 Hz \pm 250 Hz. Reconnect the audio oscillator. Readjust DEV ADJ for 4.8 kHz on all transmit channels.

High Band Transmitter Alignment Procedure (75 W or 110 W Models Only)

Step	Test Switch Position	Adjustment	Procedure
1	None	Freq. Select	Adjust to lowest frequency channel, F min, for multiple frequency model.
		L701 — L708	Turn all coil slugs to flush with top of can. Then, preset L701 and L703 to 7 turns in from top of can.
		L707, L708	Preset L707 and L708 per the preset table.
		R909, R911, R826	Adjust fully clockwise.
		C734	Preset to 2 turns from tight.
2	M3	L701, L702, L703	Peak L702, then peak L701, L702, L703 until no further improvement is obtained.
3	M3	L704, L705	Dip L704, then peak L705.
4	M5	L706, L707, L708, L704, L705.	Peak L706, L707, L708, L704, and L705, in that order. If necessary, adjust R911 to prevent M5 saturation.
5	Wattmeter	C734, R911	Peak power output with C734. Adjust R911 to 125 W (75 W models) or 130 W (110 W models).
6	M5	L707, L708	Peak L707 and L708.
7	Wattmeter	R911, C734	Adjust R911 to 125 W (75 W models) or 130 W (110 W models). Peak power output with C734.
If transmitter is tuned for a single frequency, or a maximum separation of less than 500 kHz, skip to Step 14.			
8	M3	L702	Select the <i>highest</i> frequency channel, F max and peak L702.
9	M5	L704, L706	Peak L704 and L706.
10	M3	L701, L703	Select the <i>lowest</i> frequency channel, F min. Peak L701 and L703.
11	M5	L705, L707	Peak L705 and L707.
12	Wattmeter	R911	While monitoring output power on all channels, adjust R911 so that the minimum output power among all channels is 92 W (75 W models) or 130 W (110 W models).
13	Wattmeter, M5	R911, L708	Adjust L708 for equal M5 reading on F min and F max. While adjusting L708, reset R911, if necessary, to maintain the minimum power levels stated, in Step 12. If balancing of M5 is not possible, peak L708 on the channel with the lowest M5 reading.
14	Wattmeter, M5	R911	Select the channel with the <i>lowest</i> power output (multiple frequency models only). Adjust R911 for output of 125 W for 75 W models or 130 W for 110 W models. Note M5. Readjust R911 to <i>increase</i> M5 by 2 microamperes.
15	Wattmeter	R826	While monitoring output power on all channels, adjust R826 so that the minimum output power among all channels is 125 W (75 W models) or 130 W (110 W models).
16	Wattmeter	R909	While monitoring output power on all channels, adjust R909 so that the minimum output power among all channels is 82 W (75 W models) or 120 W (110 W models).

K RADIO SET



HIGH BAND MITREK TRANSMITTER ALIGNMENT

FREQUENCY CALCULATIONS

FREQUENCY (MHz)	CALCULATION
136-174 MHz	$f_o = \frac{f_c}{12}$

Where f_o = crystal frequency, f_c = carrier frequency

Preset Table for L707 and L708			
136-146 MHz Models	Frequency of F min	146-174 MHz Models	Frequency of F min
#Of Turns From Top of Coil Can		#Of Turns From Top of Coil Can	
6 Turns	136-146 MHz	8 Turns	146-155 MHz
		7 Turns	From Above 155 to 165 MHz
		6 Turns	From Above 165 to 174 MHz

Transmitter Alignment Procedure
Motorola No. PEPS-26662-F
11-29-83 GGI

CAUTION

In positive ground systems the case of the TEK5 Meter Panel and portions of the S1056B Portble Test Set are hot with respect to the vehicle chassis due to the nature of the positive ground installation. Take necessary precautions that the test equipment does not contact the vehicle chassis.

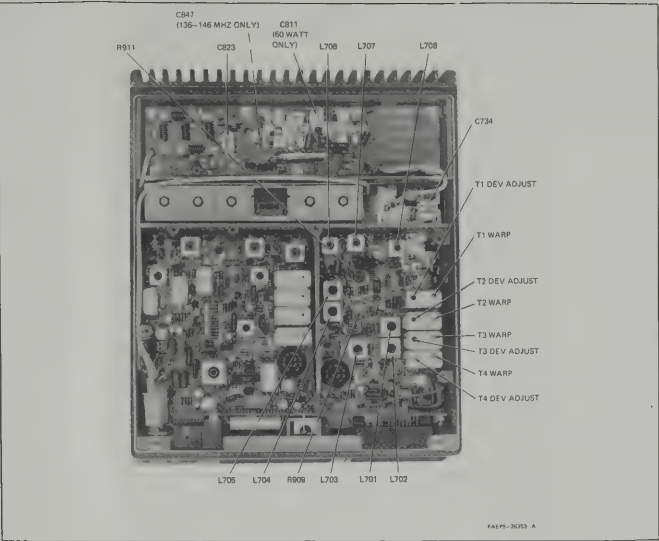
NOTE

The tuning procedure should be performed using the Motorola portable test set or the TEK5 set to position A.

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

High Band Transmitter Alignment Procedure (40 W or 60 W Models Only)			
Step	Test Switch Position	Adjustment	Procedure
1	None *	Freq. Select	Adjust to lowest frequency channel, F min, for multiple freq. models.
		L701 — L708	Turn all coil slugs to flush with top of can. Then, preset L701 and L703 to 7 turns in from top of coil can.
		L707, L708	Preset L707 and L708 per the preset table.
		R909, R911	Adjust fully clockwise.
		C734, C811, C823, C847	Preset to 2 turns from tight for C734, 1 turn from tight for C811, C823 or C847.
2	M3	L701, L702, L703	Peak L702, then peak L701, L702, L703 until no further improvement.
3	M3	L704, L705	Dip L704, peak L705.
4	M5	L706, L707, L708, L704, L705	Peak L706, L707, L708, L704, and L705, in that order. If necessary, adjust R911 to prevent M5 saturation.
5	Wattmeter	C734, C811, C823, C847	Peak power out with C734. Also peak C811 and C823 on 146-174 MHz 60 W models or C847 on all 136-146 MHz models.
6	Wattmeter	R911	Adjust R911 to 70 W for 60 W models, 47 W for 40 W Models, 40 W for 30 W models. Set R911 to the appropriate extreme position if this power level cannot be achieved.
7	M5	L707, L708	Peak L707, L708.
8	Wattmeter	C734	Peak C734.
Steps 9-11 apply to wide-spaced radios only. If transmitter is to be tuned for a single frequency, or a separation of less than 500 kHz, skip to Step 16 (136-146 MHz models) or to Step 18 (146-174 MHz models).			
9	M3	L702	Select the highest frequency channel Fmax. Peak L702.
10	M5	L704, L706	Peak L704 and L706.
11	M3	L701, L703	Select the lowest frequency channel, Fmin. Peak L701 and L703.
12	M5	L705, L707	Peak L705 and L707.
13	M5	L708, frequency select.	Adjust L708 such that the reading on M5 is the same on Fmin and Fmax. If this is not possible, peak L708 on the channel with the lowest M5 reading.
Steps 14-15 apply to 60-watt wide-spaced radios only. For 30/40 Watt (136-146 MHz models) skip to Step 16. For 40 Watt (146-174 MHz models) skip to Step 18.			
14	Wattmeter	R911, R909	Adjust R911 fully clockwise. For 136-146 MHz models select channel with lowest power. For 146-174 MHz models select channel with highest power. Adjust R909 for 68 watts out.
15	Wattmeter	C823, C847, R909	Adjust C823 or C847 so that output power of Fmin and Fmax are within 3 watts of each other. For 136-146 MHz models adjust C847 in direction of increasing power. After adjusting C823 or C847, turn R909 fully clockwise.
Steps 16-17 apply to 136-146 MHz radios only. If transmitter frequency is between 146-174 MHz skip to Step 18.			
16	Wattmeter	R911	Select channel with the lowest power out (multiple frequency models only). Adjust R911 for 68, 50 or 40 watts out for 60, 40 or 30 watt models, respectively. Recheck all channels and if necessary, readjust R911 until lowest power channel yields the power level stated above.
17	Wattmeter	R909	Adjust R909 for 64, 44 or 34 watts out for 60, 40 or 30 watt models, respectively. Select channel with lowest power out (multiple frequency models only). If power is less than 62, 43 or 33 watts for 60, 40 or 30 watt models, respectively, then readjust R909 for that minimum power.
This completes the alignment of 136-146 MHz transmitter models.			
18	Wattmeter	R911	Select the channel with the highest power output (multiple frequency models only). Adjust R911 to 70 W (60 W models) or 47 W (40 W models). If power output cannot be reduced to 70 W or 47 W, adjust R911 to fully counterclockwise.
19	Wattmeter	R909	Adjust R909 to 65 W (60 W models) or 44 W (40 W models).
This completes the alignment of 146-174 MHz transmitter models.			

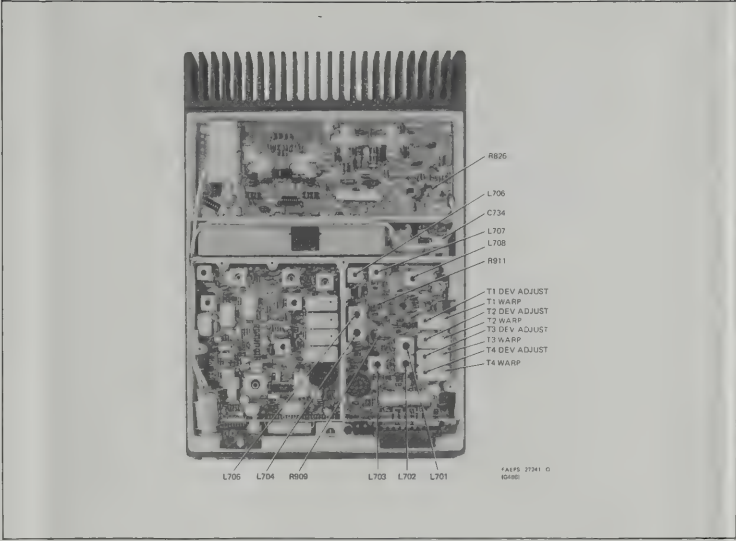


High Band MITREK Transmitter Adjustment Locations
(40 and 60 Watt Models)

FINAL METER READINGS

- Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
- All readings given in the following table are minimum (based on a nominal dc supply voltage of 13.6 volts) except M7 (PA current) which is a nominal reading.
- The readings at M3 and M5 are purely relative and do not give actual current or voltage measurements.
- Multiple the microampere scale reading obtained at M7 by 0.6 (40 W), 0.8 (60 W), or 1.3 (75 and 110 W) to determine the actual final amplifier current in amperes.

Transmitter Metering Tables			
S1056B-9B Series Switch Position	3	5	7
Meter Reading	15 uA (min)	10 uA (min)	9-13 uA (40 watt models) 9-15 uA (60 watt models) 9-15 uA (75 watt models) 11-19 uA (110 watt models)
Circuit Metered	Oscillator Output	First Amplifier Output	Final Amplifier Current



Transmitter Adjustment Locations (75 and 110 watt models)

OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator “on frequency” should be done *after* the transmitter has been aligned, but *before* transmitter deviation is checked and set. In addition, it is essential that the bottom shield is in place when this adjustment is made. Set the oscillator on frequency and perform the following steps:

Step 1. Set the frequency selector switch to the F1 position (multi-frequency units only).

Step 2. Key the transmitter with no modulation using the portable test set. On “Private-Line” and “Digital Private-Line” radios, disable the encoder output by shorting the code disable points.

Step 3. Adjust T1 warp control for proper readings on the frequency meter. If the frequency, as indicated on the frequency meter, is too low; then turn the warp control counterclockwise; if too high, turn clockwise. Set frequency within ± 75 Hz.

NOTE

Omit Steps 4 & 5 for single frequency units.

Step 4. Set the frequency selector switch to the F2 position and repeat Step 3 using T2 warp control.

Step 5. Repeat Step 4 for F3 and F4 using T3 and T4 warp controls, respectively.

DEVIATION ADJUSTMENT

The oscillator frequency adjustment must be made *before* this adjustment

Step 1: Connect the output leads of the tone oscillator through a 0.33- μ F capacitor to the transmitter audio input (microphone receptacle).

Step 2: Connect the ac voltmeter across the audio oscillator and adjust the tone generator output to 1 volt at 1000 Hz. On Private-Line radios disable the encoder by turning R23 on the PL board fully counterclockwise. On Digital Private-Line radios short the code disable points.

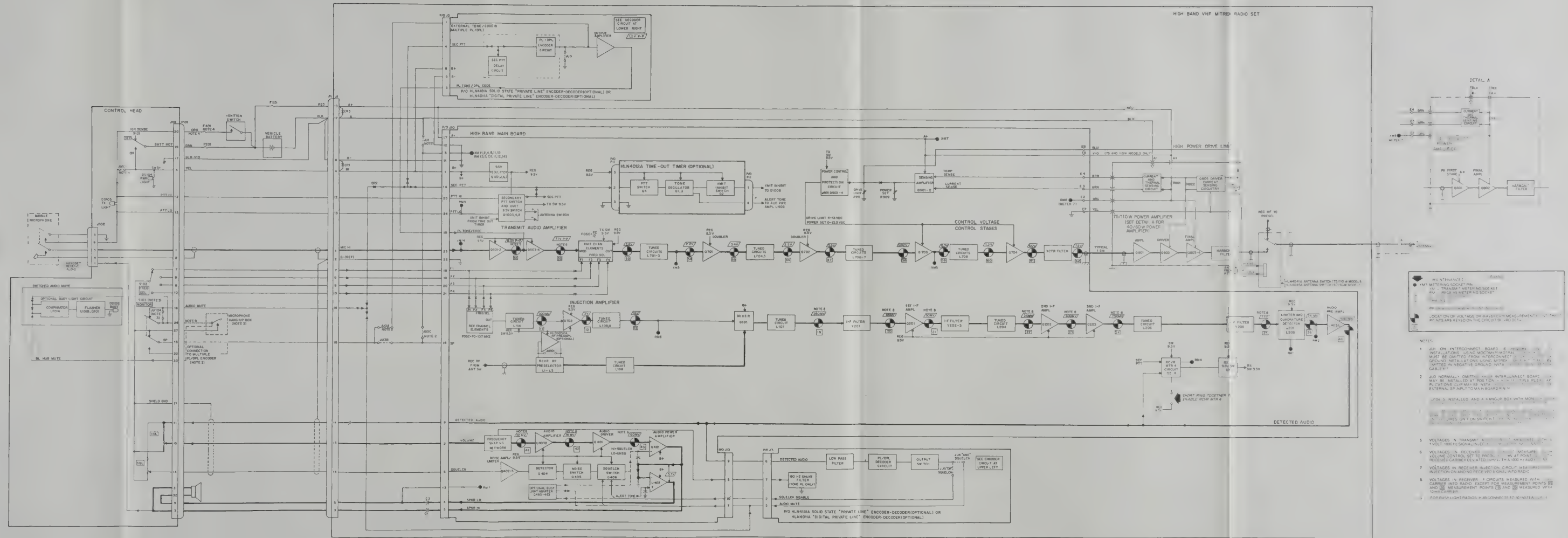
Step 3: Switch the frequency selector switch to F1 and key the transmitter. Adjust F1 DEV ADJ for:

Carrier Squelch Radio	4.8 kHz
PL DPL Radio	4.0 kHz

For multiple-frequency models, adjust the F2, F3, and F4 deviation with the frequency selector switch in the corresponding position. This completes the deviation adjustment for carrier squelch radios

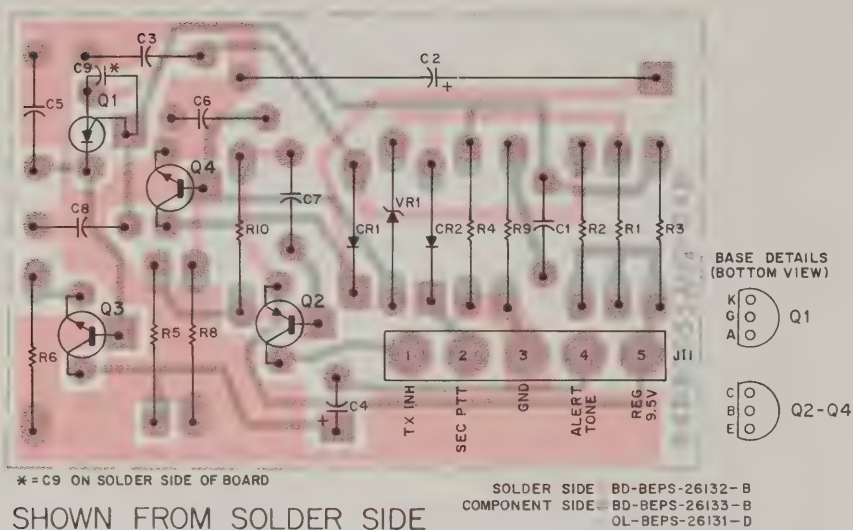
Step 4: For Private-Line or Digital Private-Line radios, disconnect the audio oscillator. On Private-Line radios adjust R23 on the PL board to set PL DEV to 700 Hz. No deviation adjustment is required for DPL radios. Private-Line or Digital Private-Line deviation should read 750 Hz \pm 250 Hz. Reconnect the audio oscillator. Readjust DEV ADJ for 4.8 kHz on all transmit channels.

High Band Transmitter Alignment Procedure (75 W or 110 W Models Only)			
Step	Test Switch Position	Adjustment	Procedure
1	None	Freq. Select	Adjust to lowest frequency channel, F min, for multiple frequency model.
		L701 — L708	Turn all coil slugs to flush with top of can. Then, preset L701 and L703 to 7 turns in from top of can.
		L707, L708	Preset L707 and L708 per the preset table
		R909, R911, R826	Adjust fully clockwise.
		C734	Preset to 2 turns from tight.
2	M3	L701, L702, L703	Peak L702, then peak L701, L702, L703 until no further improvement is obtained.
3	M3	L704, L705	Dip L704, then peak L705
4	M5	L706, L707, L708, L704, L705.	Peak L706, L707, L708, L704, and L705, in that order. If necessary, adjust R911 to prevent M5 saturation.
5	Wattmeter	C734, R911	Peak power output with C734. Adjust R911 to 125 W (75 W models) or 130 W (110 W models).
6	M5	L707, L708	Peak L707 and L708.
7	Wattmeter	R911, C734	Adjust R911 to 125 W (75 W models) or 130 W (110 W models) Peak power output with C734
If transmitter is tuned for a single frequency, or a maximum separation of less than 500 kHz, skip to Step 14.			
8	M3	L702	Select the <i>highest</i> frequency channel, F max and peak L702.
9	M5	L704, L706	Peak L704 and L706.
10	M3	L701, L703	Select the <i>lowest</i> frequency channel, F min. Peak L701 and L703
11	M5	L705, L707	Peak L705 and L707.
12	Wattmeter	R911	While monitoring output power on all channels, adjust R911 so that the minimum output power among all channels is 92 W (75 W models) or 130 W (110 W models).
13	Wattmeter, M5	R911, L708	Adjust L708 for equal M5 reading on F min and F max. While adjusting L708, reset R911, if necessary, to maintain the minimum power levels stated, in Step 12. If balancing of M5 is not possible, peak L708 on the channel with the lowest M5 reading
14	Wattmeter, M5	R911	Select the channel with the <i>lowest</i> power output (multiple frequency models only). Adjust R911 for output of 125 W for 75 W models or 130 W for 110 W models. Note M5. Readjust R911 to <i>increase</i> M5 by 2 microamperes.
15	Wattmeter	R826	While monitoring output power on all channels, adjust R826 so that the minimum output power among all channels is 125 W (75 W models) or 130 W (110 W models).
16	Wattmeter	R909	While monitoring output power on all channels, adjust R909 so that the minimum output power among all channels is 82 W (75 W models) or 120 W (110 W models).



FUNCTIONAL BLOCK DIAGRAM

TIME-OUT TIMER



parts list

HLN4012A Time-Out Timer PL-6032-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	21-82372C10	capacitor, fixed: .05 uF + 80-20%; 25 V
C2	23-83185D01	120 uF ± 10%; 15 V
C3	8-84637L38	.0033 uF ± 10%; 630 V
C4	23-84538G01	1 uF ± 20%; 35 V
C5	8-84637L32	.0068 uF ± 10%; 630 V
C6, 7	21-83596E10	220 pF ± 20%; 500 V
C8	21-82187B44	.001 uF ± 10%; 100 V
CR1, 2	48-83654H01	diode: (see note) silicon
J11	9-80098A01	connector, receptacle: female, 5 contact
Q1	48-869673	transistor: (see note) Thyristor; type M9673
Q2	48-869467	PNP; type M9467
Q3, 4	48-869642	NPN; type M9642
R1	6-124C71	resistor, fixed: ± 10%, 1/4 W; unless otherwise stated 8.2k
R2	6-124B11	360k ± 5%
R3	6-124A89	47k ± 5%
R4	6-124A97	100k ± 5%
R5	6-124A53	1.5k ± 5%
R6	6-124C33	220
R7	6-124C73	10k
R8	6-124A61	3.3k ± 5%
R9	6-124C77	15k
R10	6-124A49	1k ± 5%

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



TONE "PRIVATE-LINE" ENCODER/DECODER

MODEL HLN4181A

FUNCTION

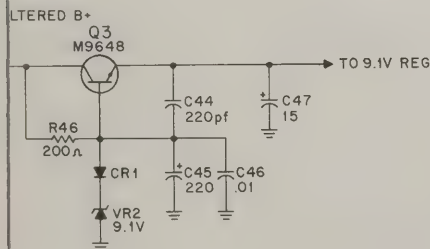
Encodes and decodes sub-audible "Private-Line" tones. Encoder modulates transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off reverse tone burst. Decoder detects received tone and un-squelches receiver when proper tone is received.

NOTES:

1. Components within dashed area form an input filter for decode tone derived from detected audio
2. All capacitor values are in μF unless otherwise stated.
3.  Theory information.
4.  Signal flow.

CAUTION

Make certain that NO power is supplied to the radio when inserting or removing the PLED circuit board. Damage to the PLED or external test equipment may result.



TRANSMITTER SECTION BOARD DETAIL

Reference Series Key	
REFERENCE	CIRCUIT
0-99	Receiver Meter 4, Receiver 9.5 V Switch
100-199	Receiver Injection and Receiver rf IF
200-299	—
300-399	—
400-459	Detector, Receiver Audio, Squelch
460-480	Busy Light Adapter
500-599	Transmit Audio
600-699	Transmit and Receive Channel Elements
700-799	Exciter
800-899	Power Amplifier
900-999	Power Control and Protection
1000-1099	Regulator, Transmitter 9.5 V Switch, PTT

parts list

P10 HLD4001C Main Board Transmitter Section RI (L = 136-146 MHz)	
P10 HLD4002B Main Board Transmitter Section RII (H = 146-174 MHz)	PL-6055-
REFERENCE	MOTOROLA

SYMBOL	PART NO.	DESCRIPTION
C501	21-83596E36	capacitor, fixed P = 5%, 500 V.
C503, S04	21-83596E10	unifast otherwise stated
C505, S06	21-83596E12	01 μ F = 60-40%; 250 V
C507	8-846371.37	220 \pm 20%
C508	21-83596E22	047 μ F \pm 10%; 250 V
C509	8-84469D03	22 \pm 20%
C510	8-84200G40	030 μ F \pm 5%; 50 V
C511	9-83819E09	0015 μ F = 5%; 100V
C512	23-84665F03	100 μ F = 100-100%; 25 V
C513	21-84448D02	01 μ F = 20% \pm 100 V
C514	21-84428B06	47 100V
C515	21-84406D32	36 100V
C702L	21-82450B18	2
C703	21-82450B18	1.5
C704	21-82450B18	56
C705	21-82450B18	56
C706	21-82450B18	2
C707	21-82450B18	4
C708	21-82450B18	1.5
C709	21-83738B17	100 200 V
C710	21-83459132	120
C711	21-84459131	100 200 V
C712	21-84459131	68 200 V
C713	21-83596E13	001 μ F \pm 10%; 100 V
C714	21-83596E13	47 \pm 10%; 250 V
C715	21-83596E13	001 μ F \pm 10%; 100 V
C716	21-83596E36	01 μ F = 60-40%; 200 V
C717	21-83406D67	22
C718	21-90171A36	16 N330
C719	21-82450B08	1.2
C720	21-82450B39	0.91
C721	21-83406D57	43
C722	21-83406D56	24
C723	21-83406D67	43
C724	21-82450B18	56
C725	21-83596E13	001 μ F \pm 10%; 100 V
C726	21-86171A52	13 N220
C727	21-86171A54	9 N220
C728	21-82450B13	1.5
C729	21-82450B47	10
C730	21-82450B49	11 \pm 5 pF
C731	21-83406D63	18
C732	21-83406D56	24
C733	21-83596E13	001 μ F \pm 10%; 100 V
C734	21-83406D55	0.2 \pm 10%

68P81039E29-C
(Sheet 1 of 5)
11-29-83 GGI

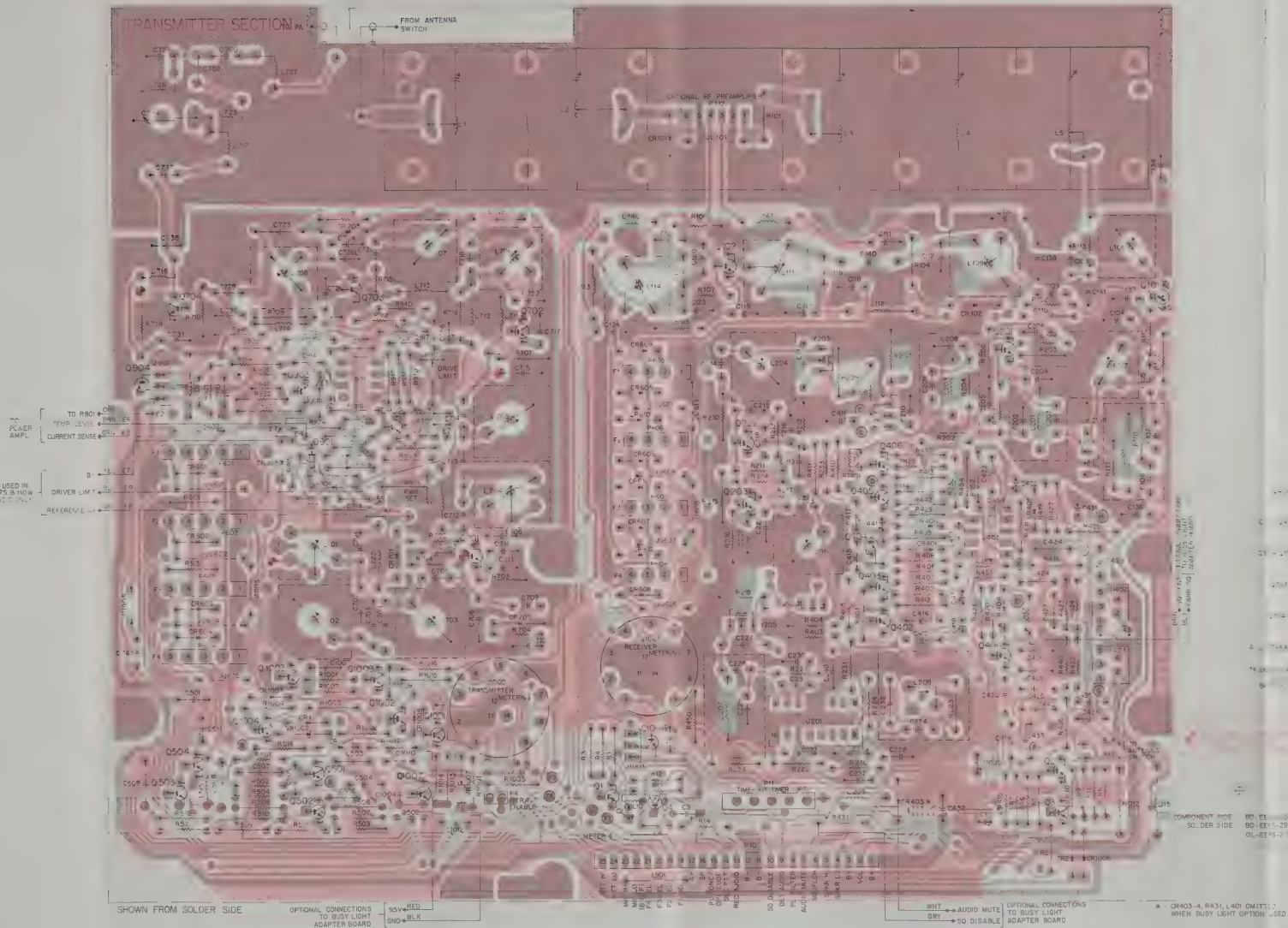
SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C724	21-83596E13	.001 μ F \pm 10%; 100 V
C725	21-83594A04	50-200 V
C726L	21-83400E01	33
C726H		NOT USED
C726L	21-8202467B	16, 1470
C726H	21-80171A2B	10, 4330
C730L	21-84483B27	51, 200 V
C730H	21-83406E01	33
C731	21-82372C10	.05 μ F \pm 20%; 25 V
C734	20-84579B11	variable; 7.57 pF; 100 V
C737	21-83596E10	220 \pm 20%
C738L	21-84607E32	190 \pm 10%
C738H	21-83596E38	.01 μ F \pm 80-100%; 250 V
C743	21-83596E13	.001 μ F \pm 10%; 100 V
C747	21-82372C20	15 \pm 10% \pm 20%; 25 V
C756	20-84535G03	.01 μ F \pm 20%; 35 V
C756L	21-83406E07	8
C756H	21-8202467B	8
C759H	21-84483B38	100, 200 V
C759L	21-83406E07	51, 200 V
C760H	21-82372A03	6
C761	21-82372C10	.05 μ F \pm 20%; 25 V
C802, 807	21-82181B44	.001 μ F \pm 10%; 100 V
C908	21-84637L31	.047 μ F \pm 10%; 250 V
C909	21-82181B44	.001 μ F \pm 10%; 100 V
C910	21-83596E02	47 μ F
C914	21-82372C10	.05 \pm 25 V
C916	21-84535G024	5 \pm 56 μ F
C917	21-82181B44	.001 μ F \pm 10%; 100 V
C921	21-82372C10	.05 \pm 20%, 25
C921	21-83596E10	220 μ F \pm 20%
C940	21-82372C10	220 \pm 20%
C1004	21-83596E37	.01 μ F \pm 70-100%; 100 V
C1005	21-84666F07	15 μ F \pm 100-100%; 25 V
C1007	21-82372C10	220 \pm 20%
C1008	21-84666F03	100 \pm 100%, 10-25 V
C1009	21-8441613	.0015 μ F \pm 25%; 250 V
C1010	21-83596E38	.01 μ F \pm 100-100%; 200 V
C1012	21-83596E38	.01 μ F \pm 80-400%; 250 V
C1801	21-82372C10	.05 \pm 20%, 25 V
C1921	21-83596E10	220 \pm 20%
CR601 thru 604	48-33054A01	diode: (see note)
CR701	48-32466H13	silicon
CR702	48-32196G01	germanium
CR705	48-32196G01	germanium
CR901	48-32466H13	silicon
CR902	48-32466H13	silicon
CR905	48-33054A01	silicon
CR907	48-32466H13	silicon
CR908	48-32466H13	silicon
CR1001	48-33054A02	silicon
CR1003	48-33054A01	silicon
CR1005	48-33054A01	silicon
CR1006	48-32466H13	silicon
		connector, receptacle:
J901	9-9002B0A1	female, 3 contact
J1002	9-90217A01	female, 12 contact
J1003	9-9002B0A1	female, 3 contact
		coil:
L515	24-8003A0A2	choke, 1/2 in.
L701	24-80337G11	1 1/2 in. (VIO)
L702	24-80066A17	6 1/2 in. (VEL)
L704	24-80066A18	1 1/2 in. (ORG)
L705	24-80066A19	1 1/2 in. (WHT)
L706	24-8003A0A2	3 1/2 in. (VIO)
L707	24-8003A0A3	3 1/2 in. (RED)
L708	24-8003A0A4	3 1/2 in. (ORG)
L710	24-8235G013	choke, 3 1/2 in.
L712	24-8235G013	choke, 3 1/2 in.
L714	24-8235G013	choke, 0.82 μ H
L715	24-8235G013	choke, 0.82 μ H
L716	24-8235G013	choke, 0.82 μ H
L717	24-84883G13	choke, 0.82 μ H
L718	24-84883G13	choke, 0.82 μ H
L719	24-84883G13	choke, 0.82 μ H
L720	24-84883G13	choke, 0.82 μ H
L721	24-84883G13	choke, 0.82 μ H
L722	24-84883G13	choke, 0.82 μ H
L723	24-84883G13	choke, 0.82 μ H
L724	24-84883G13	choke, 0.82 μ H
L725	24-84883G13	choke, 0.82 μ H
L726	24-84883G13	choke, 0.82 μ H
L727	24-84883G13	choke, 0.82 μ H
L728	24-8235G013	choke, 0.82 μ H
L729	24-8235G013	choke, 3.3 μ H
		connector, plug:
P601 thru 604	28-80096A02	male, 5 contact

Q501	48-889643	PNP; type M9643
Q502, 503	48-889642	NPN; type M9642
Q504	48-889643	PNP; type M9643
Q701	48-889494	NPN; type M9494
Q702	48-889638	NPN; type M9638
Q703	48-889657	NPN; type M9657
Q704	48-889859	NPN; type M9859
Q901	48-889652	field-effect; type M952
Q902	48-889643	PNP; type M9643

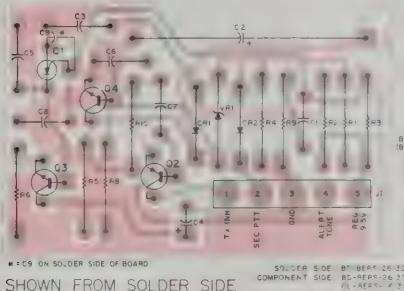
REPAIRER SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q003	48-809642	NPN; type M9642
Q004	48-84411,10	PNP; type M1110
Q1001, 1002	48-809642	NPN; type M9642
Q1003	48-809640	NPN; type M9680
Q1004	48-809643	PNP; type M9643
Q1006	48-84411,10	PNP; type M1110
Q1007	48-809642	NPN; type M9642
Q1008	48-809643	PNP; type M9643
		resistor, fixed: $\pm 10\%$; 1/4 W; unless otherwise stated
R501	6-12AC43	560
R502, 503	6-12AC63	27k
R504, 505	6-12A413	33 $\pm 5\%$
R506, 507	6-12AC33	68k
R508, 509	6-12AC73	10k
R510	6-12A469	6.8k $\pm 5\%$
R511, 512	6-12A470	7.5k $\pm 5\%$
R513	6-12A413	560
R514	6-12AC01	10
R601	6-12AC85	4.7k
R702	6-12A402	62k $\pm 5\%$
R703	6-12AC05	15
R704	6-12AC73	10k
R707	6-12AC17	47
R708	6-12AC75	12k
R709	6-12AC23	62
R710	6-12AC03	12
R711	6-12A449	1k $\pm 5\%$
R715	6-12AC23	62
R716	6-12AC25	100
R719	6-12SC11	100, 1/2 W
R907	6-12AC81	22k
R908	6-12AC55	1.8k
R909	18-8026B902	variable; 5k
R910	6-12AC87	39k
R911	18-8026B905	variable; 50k
R912	6-12A470	18k $\pm 5\%$
R913	6-12A473	10k $\pm 5\%$
R914	6-12A487	100k $\pm 5\%$
R915	6-12AC27	120
R916, 917	6-12AC85	4.7k
R918	6-12AC39	380
R919	6-12SC29	150, 1/2 W
R920	6-12AC25	100
R921	6-12AC43	560
R922	6-12AC46	1k
R924	6-12AC29	150
R925	6-12AC33	220 $\pm 5\%$
R927	6-12AC87	6.8k
R928	6-12A490	51k
R941	6-12A449	1k
R1001	6-12AC53	1.5k
R1002	6-12A422	75 $\pm 5\%$
R1003	6-12A419	56 $\pm 5\%$
R1004	6-12AC43	1k
R1005	6-12AC73	10k
R1006	6-12AC49	1k
R1007	6-12AC73	10k
R1012	6-12SC03	12, 1/2 W
R1013	6-12AC49	1k
R1014	6-12AC73	10k
R1015	6-12AC87	5.6k
R1016	6-12AC67	5.6k
R1017	6-12AC39	390
R1918	6-12AC43	560 $\pm 10\%$
		Integrated circuit: (see note) type M2170
U901	51-84621K70	
		voltage regulator: Zener type: 5.1 V
VR904	48-8225C51	Zener type: 7.5 V
VR1002	48-8225C44	Zener type: 10 V
VR1007	48-83461E18	
		mechanical parts
	26-80196AD1	CAN. coil for L701-L705
	26-80039AD1	CAN. coil for L706-L708
	14-60001C01	INSULATOR FOR G703, Q704

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers

HLN4045A Antenna Switch is not field repairable and replacements should be ordered as a unit.



TIME-OUT TIMER



parts list

HCLN4012A Time Out Timer PL 6832C

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		capacitor, fixed
C1	238279C70	15 μ F = 10% 25 v
C2	2383485D01	120 pF = 10% 15 V
C3	238452130	2000 pF = 10% 630V
C4	2384536D1	1 μ F = 20% 35 V
C5	238467135	1000 pF = 10% 630 V
C6 C7	2183580C10	220 pF = 10% 500 V
C8	2182187B44	1001 μ F = 10% 100 V
		diode (see note)
CR1 2	48 836544D1	silicon
		connector, receptacle
J11	9 8009A01	female 5 contact
		transistor (see note)
Q1	48 8696R3	Thy. str. type M9673
Q2	48 8696R8	PNP type M9671
Q3 Q4	48 8696R2	NPN type M9642
		resistor, fixed = 10%, 1/4 W. unless otherwise stated
R1	6 124C71	6.2 Ω
R2	6 124B11	360 Ω 5%
R3	6 124A89	47 Ω 5%
R4	6 124A87	100 Ω = 5%
R5	6 124A53	1.5 Ω 5%
R6	6 124C33	220 Ω
R7	6 104C73	10 Ω
R8	6 124A61	3 Ω = 5%
R9	6 124C17	15 Ω
R10	6 124A49	1 Ω = 5%

note For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TONE "PRIVATE-LINE" ENCODER/DECODER

MODEL HLN4181A

FUNCTION

Encodes and decodes sub-audible "Private-Line" tones. Encoder modulates transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off reverse tone burst. Decoder detects received tone and un-squelches receiver when proper tone is received.

- NOTES
- Components within dashed area form an input filter for decode tone derived from detected audio.
 - All capacitor values are in μF unless otherwise stated.
 - Theory information.
 - Signal flow.
- CAUTION**
Make certain that NO power is supplied to the radio when installing or removing the PLED circuit board. Damage to the PLED or external test equipment may result.

parts list

HLN4181A Code Plug PLED PLW-0049-0

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	23-84665F03	capacitors, fixed
C2	08-84637L15	electrolytic, 100 μF , 25 VDC
C3	08-84637L27	Mylar, 0.27 μF $\pm 5\%$, 100 VDC
C4, C5	23-84665F14	electrolytic, 220 μF , 50 V
C6	23-84665F02	electrolytic, 0.01 μF , 25 VDC
C7	21-82187B16	ceramic disc, 0.003 μF $\pm 10\%$, 100 V
C8	21-82187C10	ceramic disc, 0.05 μF $\pm 20\%$, 25 V
C9, C10	23-84665F04	not used
C11	21-82187B16	tantalum, 22 μF , 20 V
C12, C14	08-84637L42	Mylar, 0.47 μF $\pm 10\%$, 100 V
C15, C19	21-82187B44	ceramic disc, 0.001 μF $\pm 10\%$, 100 V
C20	23-84665F03	electrolytic, 100 μF , 25 VDC
C21, C23	21-82187B44	ceramic disc, 0.001 μF $\pm 10\%$, 100 V
C24	23-84665F04	electrolytic, 1 μF , 50 VDC
C25	23-84665F02	electrolytic, 15 μF , 25 VDC
C26	08-84637L06	Mylar, 0.0069 μF $\pm 5\%$, 630 VDC
C27	21-82187B44	ceramic disc, 0.001 μF $\pm 10\%$, 100 V
C28	08-84637L15	Mylar, 0.27 μF $\pm 5\%$, 100 V
C29	08-84637L23	Mylar, 0.0012 μF $\pm 5\%$, 1000 V
C30	08-84637L05	Mylar, 0.0039 μF $\pm 5\%$, 630 V
C31	08-84637L21	Mylar, 0.15 μF $\pm 5\%$, 100 V
C32	21-82187B44	ceramic disc, 0.001 μF $\pm 10\%$, 100 V
C33	23-84665F01	electrolytic, 10 μF $\pm 10\%$, 25 VDC
C34	08-83813K08	Mylar, 0.006 μF $\pm 10\%$, 100 V
C35	—	not used
C36	23-84538S01	tantalum, 1 μF $\pm 20\%$, 35 V
C37	21-00861209	ceramic disc, 600 pF $\pm 10\%$
C38	08-84637L37	Mylar, 0.1 μF $\pm 5\%$, 100 V
C39	23-84665F01	electrolytic, 10 μF $\pm 10\%$, 25 VDC
C40	08-84637L36	Mylar, 0.082 μF $\pm 5\%$, 100 V
C41	21-83596E10	ceramic disc, 220 pF $\pm 20\%$, 500 V

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C42	21-82187B44	ceramic disc, 0.001 μF $\pm 10\%$, 100 V
C43	21-83596E36	ceramic disc, 0.01 μF $\pm 60\%$, 250 V
C44	21-83596E10	ceramic disc, 220 pF $\pm 20\%$, 500 V
C45	23-84665F14	electrolytic, 220 μF , 50 V
C46	21-83596E36	ceramic disc, 0.01 μF $\pm 60\%$, 250 V
C47	23-84665F02	electrolytic, 15 μF , 25 VDC
C48	—	not used
C49	21-82187C10	ceramic disc, 0.05 μF $\pm 20\%$, 25 V
C50, C58	21-83596E10	PROM version only
C59, C60	21-82187C10	ceramic disc, 220 pF $\pm 20\%$, 500 V
C62	—	PROM version only
R1	06-11009C74	resistor, fixed, ohms $\pm 5\%$, 1/4 W unless otherwise specified
R2	06-10621C63	5110 $\pm 1\%$, 1/4 W
R3	06-11009C39	120k
R4	06-11009C21	56k
R5	06-10621D58	487k $\pm 1\%$, 1/4 W
R6	06-10621D57	47.5k $\pm 1\%$, 1/4 W
R7	06-11009C43	560
R8	06-11009D04	180k
R9	06-11009C36	120k
R10	06-11009C22	160k
R11	06-11009C39	130k
R12	—	not used
R13	06-10621D44	24.8k $\pm 1\%$, 1/4 W
R14	06-11009C43	560
R15	06-11009C42	not used
R16	—	not used
R17	06-11009C73	10k

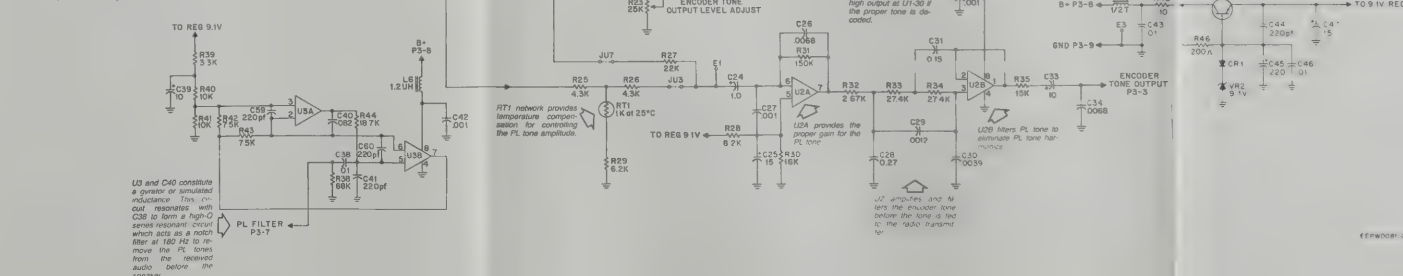
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R18, R20	06-11009C28	47k
R21	06-11009C25	100
R22	06-11009C81	22k
R23	18-84644C20	25k variable potentiometer
R24	06-11009C83	27k
R25, R26	06-11009C84	4.3k
R27	06-11009C81	22k
R28	06-11009C71	8.2k
R29	06-11009C68	6.2k
R30	06-11009C78	10k
R31	06-10621E06	150k $\pm 1\%$, 1/4 W
R32	06-10621C38	2670 $\pm 1\%$, 1/4 W
R33, R34	06-10621D34	27.4k $\pm 1\%$, 1/4 W
R35	06-11009C77	15k
R36, R37	06-11009C28	47k
R38	06-11009C30	68k
R39	06-11009C61	3.3k
R40, R41	06-10621C91	10k $\pm 1\%$, 1/4 W
R42, R43	06-10621C79	7500 $\pm 1\%$, 1/4 W
R44	06-10621D18	187k $\pm 1\%$, 1/4 W
R45	06-11009C21	10
R46	06-11009C32	200
R47, 49	—	not used
R50, 75	—	PROM version only
RT1	06-8360K02	thermistor: 1K Ω at 25°C
L1, L2	24-82723H27	coll. choke: 1.2 μH
L3	24-80035A02	1/2 turn, ferrite
L4, L6	24-82723H27	1.2 μH

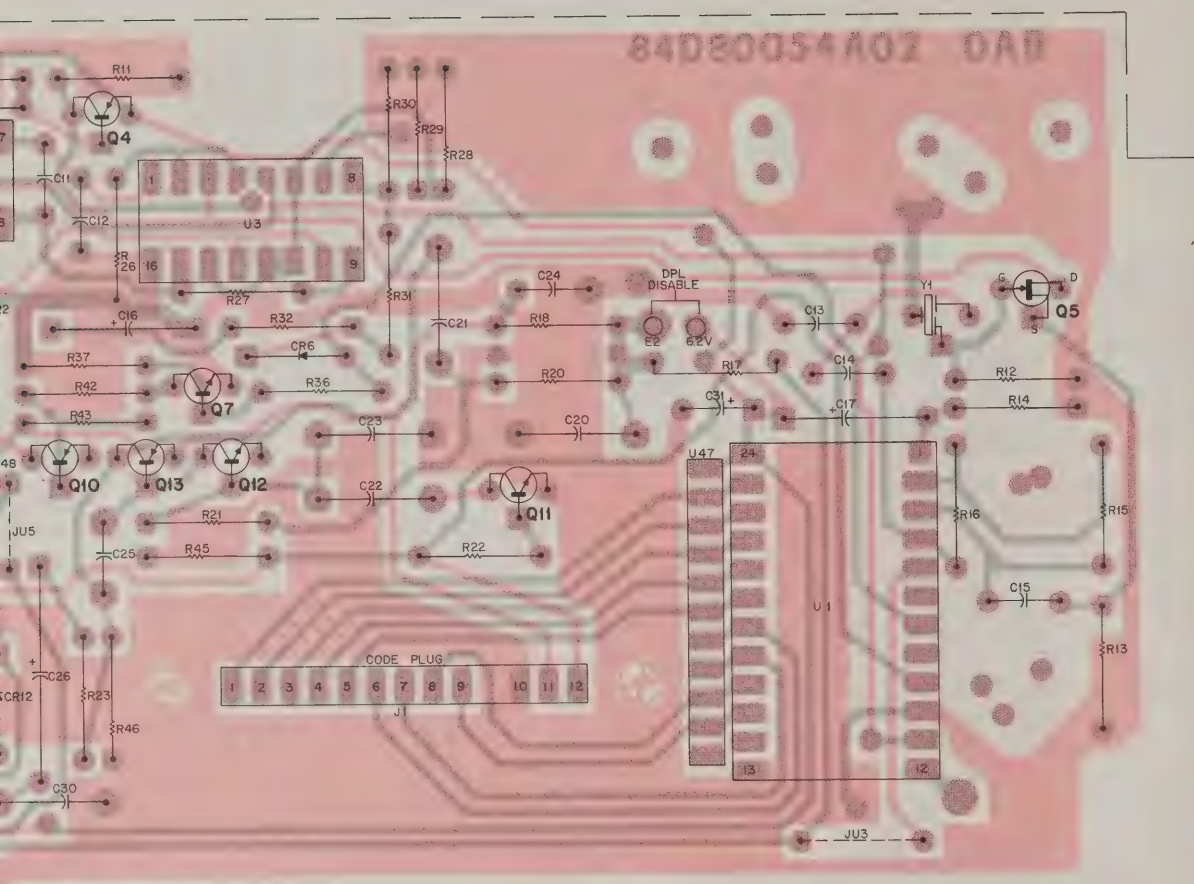
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q1	48-00869E42	transistor: type M9642, NPN
Q2	48-00869E42	type M9642, PNP
Q3, Q5	—	PROM version only
JU3, JU4	10-00000S18	22 sol ind
JU8	10-00000S18	22 sol ind
CR1	48-83654H01	diode: silicon
CR2, CR3	48-83329D04	silicon reference
VR1	48-82256C44	zener, 7.5 V, 400 mW
VR2	48-82256C38	zener, 9.1 V, 400 mW
VR3	48-82256C33	zener, 2.7 V, 400 mW
CR50, 57	—	PROM version only
U1	51-83977M17	integrated circuit: M7171 encoder/decoder
U2, U3	51-83067C03	M7176 op amp
U50	—	PROM version only
Y1	48-80055C01	crystal: crystal tuning fork
P3	28-80073A02	8-pin socket
J1	09-80069B04	40-pin IC socket (U1)
J3	09-82071K01	code plug socket, 13-pin

JUMPER TABLE

JU1	NORMALLY OUT - INSTALLED FOR PL TONE DISABLE
JU2	NORMALLY IN - REMOVED WHEN USING EXTERNAL TONE
JU3	USED FOR "AND" SQUELCH
JU4	USED FOR "OR" SQUELCH
JU5	NORMALLY OUT - INSTALLED FOR CARRIER SQUELCH OPERATION
JU6	NORMALLY IN - REMOVED WHEN USING EXTERNAL TONE
JU7	NORMALLY IN - REMOVED FOR REVERSE BURST DISABLE
JU8	NORMALLY IN

"And" Squelch is Normally Used Unless Otherwise Specified.





SHOWN FROM SOLDER SIDE

COMPONENT SIDE
SOLDER SIDE

BD-DEPW-0082-0
BD-DEPW-0083-0
OL-DEPS-26098-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q1	48-869648	NPN; type M9648
Q2	48-869642	NPN; type M9642
Q3, 4	48-869643	PNP; type M9643
Q5	48-869653	FET; type M9653
Q6	48-869643	PNP; type M9643
Q7	48-869642	NPN; type M9642
Q8	48-869568	NPN; type M9568
Q9, 10	48-869643	PNP; type M9643
Q11, 12	48-869642	NPN; type M9642
Q13	48-869643	NPN; type M9643
resistor, fixed ($\pm 5\%$, $\frac{1}{4}$ W); unless otherwise stated		
R1	6-11009C93	68k
R2	6-11009C99	120k
R3, 4, 5	6-10621D64	56.2k $\pm 1\%$; $\frac{1}{8}$ W
R6	6-11009C55	1.8k
R7, 8	6-11009C73	10k
R9	6-11009C59	2.7k
R10	6-11009C73	10k
R11	6-11009C83	27k
R12	6-11009D08	270k
R13	6-11009C77	15k
R14	6-11009C97	100k
R15	6-11009D04	180k
R16	6-11009D14	470k
R17	6-11009C91	56k
R18	6-11009C92	62k
R20, 21	6-11009C97	100k
R22	6-11009C75	12k
R23	6-11009C77	15k
R24, 25	6-11009C33	220 ohms
R26	6-11009C73	10k
R27	6-11009C89	47k
R28	6-10621D80	82.5k $\pm 1\%$; $\frac{1}{8}$ W
R29	6-11009D14	470k
R30	6-11009C95	82k
R31	6-11009C99	120k
R32	6-11009C95	82k
R33	6-11009C49	1k
R34	6-11009C93	68k
R35	6-11009C79	18k
R36	6-11009C99	120k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R37	6-11009C95	82k
R38	6-11009C89	47k
R39	6-11009D02	150k
R40	6-11009C73	10k
R41	6-11009C49	1k
R42, 43	6-11009C89	47k
R44	6-11009D08	270k
R45	6-11009C93	68k
R46	6-11009C49	1k
R48	6-11009C33	220 ohms
R49	6-11009C99	120k
integrated circuit (see note):		
U1	51-84267A82	type N6782
U2	51-84320A55	type LM565CN
U3	51-84320A79	type CA3096AE
U47	51-82142K02	resistor network
voltage regulator (see note):		
VR10	48-83696E07	Zener, 6.2 V
VR11	48-82256C11	Zener, 10 V
VR12	48-82256C51	Zener, 5.1 V
crystal, resonator:		
Y1	48082003K01	50 kHz
mechanical parts		
	14-861196	INSULATOR, transistor
	3-10904A02	SCREW, machine: M3.5 x 0.6 x 6
	3-10904A15	SCREW, machine: M3.5 x 0.6 x 13
	4-80149A01	WASHER, captive: 4 used
	29-10271A15	TERMINAL, pin: 2 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

**MOTOROLA INC.**Communications
Group

instruction manual revision

GENERAL

The attached General Safety Information sheet contains new important information. This revision consists of changes that have occurred since your instruction manuals were printed. Please correct your manuals accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E65-O	<i>Mitretek Two-Way FM Radio, 29.7-50 MHz, 60/100 Watts</i>
68P81045E70-O	<i>Mitretek Two-Way FM Radio, 136-174 MHz, 40/60/75/110 Watts</i>
68P81045E75-A	<i>Mitretek Two-Way FM Radio, 403-420 and 450-512 MHz, 30/50/75/100 Watts</i>
68P81045E80-O	<i>Mitretek Two-Way FM Radio, 806-825 Transmit, 851-870 Receive 12/35 Watts</i>
68P80100W30-O	<i>Motrek Two-Way FM Radio, 150.8-162 MHz, 35/55/100 Watts</i>
68P80100W35-O	<i>Motrek Two-Way FM Radio, 450-470 MHz, 30/45/90 Watts</i>

REVISION DETAILS:

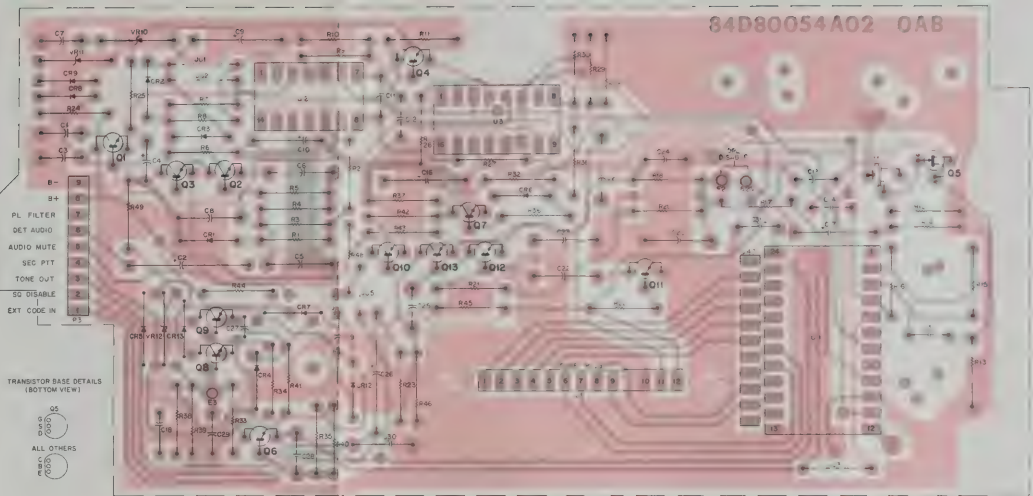
1. In Instruction Manual 68P81045E65-O, directly following Page viii, remove 68P81045E71-O and replace it with the attached 68P80200W01-B.
2. In Instruction Manual 68P81045E70-O, directly following Page viii, remove 68P81045E71-O and replace it with the attached 68P80200W01-B.
3. In Instruction Manual 68P81045E75-A, directly following Page viii, remove 68P80200W01-O and replace it with the attached 68P80200W01-B.
4. In Instruction Manual 68P81045E80-O, directly following Page viii, remove 68P81045E71-O and replace it with the attached 68P80200W01-B.
5. In Instruction Manual 68P80100W30-O, directly following Page viii, remove 68P80200W01-A and replace it with the attached 68P80200W01-B.
6. In Instruction Manual 68P80100W35-O, directly following Page vii, remove 68P80200W01-A and replace it with the attached 68P80200W01-B.

MODEL HLN4011A

Encodes and decodes *Digital Private-Line codes*. Encoder modulates transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off code. Decoder detects received tone and un-squelches receiver when proper code is received.

HLN4011A "Digital Private-Line" Encoder/Decoder Board P. 6050 F

REFERENCE	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed (mf. = 5%, 50 V):
C1	21-83596F36	01 = 10%, -40%, 250 V
C2	21-846940A5	50 = 10%, 10%, 250 V
C3	21-83599536	01 = 10%, -40%, 250 V
C4	21-83593004	15 = 20%, 20, 250 V
C5	8-83595039	022
C6	8-83813423	068
C7	21-83596536	01 = 10%, -40%, 250 V
C8	8-83813919	0039
C9	21-83476203	10 = 10%, 20, 250 V
C10	21-83597848	58 = 35 V
C11, C12	81-82187844	001 = 10%, 100 V
C13	21-80067A85	100 pf, 200 V
C14	21-80070440	20 pf, 250 V
C15	21-83596538	0047 = 10%, 100 V
C16, C17	21-83476207	4.7 = 20%, 10 V
C18	21-83275710	05 = 20%, 25 V
C19	21-83483022	6.8 = 10%, 20 V
C20	8-83813914	043
C21	8-83813924	038
C22	8-8381326	0056
C23	8-83813927	0030; 100 V
C24	21-83596536	01 = 20%, -40%, 250 V
C25	21-82187844	001 = 10%, 100 V
C26	21-846940A5	50 = 10%, 100 V
C27	21-83596508	2.2 = 20%, -30%, 20 V
C28, 29	21-83596510	220 pf = 20%, 500 V
C30	8-83484028	0068
C31	21-84583002	4.7 = 20%, 20 V
		diode (see note):
CR1	48-83654402	silicon
CR2, 3	48-83611601	silicon, hot-camer
CR4	48-83615491	silicon
CR5	48-82466413	red silicon
CR6 thru 9, 12	48-83654401	silicon
CR13	48-83654401	silicon
		connector, receptacle
J1	9-8271001	female, 12-contact
		connector, plug
P3	28-80181802	male, 3-contacts



SHOWN FROM SOLDER SIDE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transistor (see note):
Q1	48-809648	PNP, type M9648
Q2	48-809642	PNP, type M9642
Q3, 4	48-809643	PNP, type M9643
Q5	48-809653	FET, type M9653
Q6	48-809643	PNP, type M9643
Q7	48-809642	PNP, type M9642
Q8	48-809658	PNP, type M0558
Q9, 13	48-809643	PNP, type M9643
Q11, 12	48-809642	PNP, type M9642
Q14	809693	PNP, type M9693

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R37	6-11009C95	82 μ
R38	6-11009C88	47 μ
F30	6-11009C02	150 Ω
R40	6-11009C73	10 Ω
R41	6-11009C48	1k
R42, 43	6-11009C89	47 μ
R44	6-11009C08	270 Ω
R45	6-11009C93	66k
R46	6-11009C49	1k
R48	6-11009C33	220 ohms
R49	6-11009C98	150 Ω

	resistor, fixed $\pm 5\%$, $\frac{1}{4}$ W; unless otherwise stated
R1	6-11009C93 68k
R2	6-11009C99 120k
R3 & 4	6-10621D64 56.2k $\pm 1\%$, $\frac{1}{4}$ W
R6	6-11009C55 1.8k
R7 & 8	6-11009C73 10k
R9	6-11009C59 2.7k
R10	6-11009C73 10k
R11	6-11009C63 27k
R12	6-11009D08 270k
R13	6-11009C77 15k
R14	6-11009C97 100k

U1	51-84267A82	integrated circuit (see note)
U2	51-84320A55	type N6782
U3	51-84320A70	type LM565CN
U47	51-82142K02	type CA3909AE
		resistor network
		voltage regulator (see note)
VR10	48-83695E07	Zener: 6.2 V
VR11	48-82256C11	Zener: 10 V
VR12	48-82256C51	Zener: 5.1 V
		crystal resonator
Y1	48082003K01	50 kHz

Note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

**MOTOROLA INC.**Communications
Group

instruction manual revision

GENERAL

The attached General Safety Information sheet contains new important information. This revision consists of changes that have occurred since your instruction manuals were printed. Please correct your manuals accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E65-O	<i>Mitretek Two-Way FM Radio, 29.7-50 MHz, 60/100 Watts</i>
68P81045E70-O	<i>Mitretek Two-Way FM Radio, 136-174 MHz, 40/60/75/110 Watts</i>
68P81045E75-A	<i>Mitretek Two-Way FM Radio, 403-420 and 450-512 MHz, 30/50/75/100 Watts</i>
68P81045E80-O	<i>Mitretek Two-Way FM Radio, 806-825 Transmit, 851-870 Receive 12/35 Watts</i>
68P80100W30-O	<i>Motrek Two-Way FM Radio, 150.8-162 MHz, 35/55/100 Watts</i>
68P80100W35-O	<i>Motrek Two-Way FM Radio, 450-470 MHz, 30/45/90 Watts</i>

REVISION DETAILS:

1. In Instruction Manual 68P81045E65-O, directly following Page viii, remove 68P81045E71-O and replace it with the attached 68P80200W01-B.
2. In Instruction Manual 68P81045E70-O, directly following Page viii, remove 68P81045E71-O and replace it with the attached 68P80200W01-B.
3. In Instruction Manual 68P81045E75-A, directly following Page viii, remove 68P80200W01-O and replace it with the attached 68P80200W01-B.
4. In Instruction Manual 68P81045E80-O, directly following Page viii, remove 68P81045E71-O and replace it with the attached 68P80200W01-B.
5. In Instruction Manual 68P80100W30-O, directly following Page viii, remove 68P80200W01-A and replace it with the attached 68P80200W01-B.
6. In Instruction Manual 68P80100W35-O, directly following Page vii, remove 68P80200W01-A and replace it with the attached 68P80200W01-B.



MOTOROLA INC.

Communications
Group

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave, and rural telephone RF equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

WARNING

For vehicles equipped with electronic anti-skid braking systems, see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

NOTE

See Page 2 for another important warning.

WARNING

It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard.

National Fire Protection Association standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicles. This standard requires that:

1. Any space containing radio equipment shall be isolated by a seal from the space in which the LP-gas container and its fittings are located.
2. Remote (outside) filling connections shall be used.
3. The container space shall be vented to the outside.

Installation Safety Warning

Consider the occupants' safety when you choose a location for the radio. Do not mount the radio overhead or on a sidewall unless you take special precautions.

If someone were to remove the radio and fail to latch it properly when replacing it, road shock could bump the radio loose, and the falling radio could in some circumstances cause serious injury to the driver or a passenger. In a crash, the radio, even when properly installed, could break loose and become a dangerous missile.

If you must mount the radio overhead or on a sidewall, give it the added protection of a retaining strap. Custom-made straps are available from Motorola National Parts. Order kit number HLN4698A (for *Mitrek*) or HLN4697A (for *SYNTOR* or *SYNTOR X*).



MOTOROLA INC.

**Communications
Group**

instruction manual revision

Supersedes SMR-4030

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct your manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E65-O	MITREK Two-Way FM Radio, 29.7-50 MHz
68P81045E70-O	MITREK Two-Way FM Radio, 136-174 MHz
68P81037E75-B	MITREK Two-Way FM Radio, 403-420 MHz and 450-512 MHz

REVISION DETAILS:

A. Please add the attached revised page to your manual:

68P81039E22-E, Tone "Private-Line" Decoder, replaces 68P81039E22-C/D. On this schematic, please change the reference on JU5 to Note 3, and replace Note 3 with the following:

"For two-reed operation, solder-side jumpers JU4 and JU 5 must be OUT. For one-reed operation, both jumpers must be IN and reed inserted in VS1 (encoder) position."

B. On the MITREK Accessories page, please change the Mobile Microphone to Model HMN4000B/HMN4001B, and make the following change to parts list PL-6059-O/A:

ADD

MK321	01-80706T87	electret board, coated
-	15-82896M01	retainer
-	03-135084	screw (2 used)
-	29-5355	lug
-	37-12706	grommet

DELETE

MK321	59-82933CO2	cartridge, dynamic
-------	-------------	--------------------

Page 1 of 1

technical publication services

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Fort Worth, Texas 76137
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WMR-0008

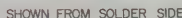
8/1/82-TP

MODEL HLN4020B



68P81039E22-F
8/1/82-TP

MODEL HLN4020B



HI N4020B Tone "Private-Line" Encoder/Decoder Board PL-6029-G

PL-6029-G

REFERENCE MOTOROLA

REFERENCE	MOTOROLA
-----------	----------

note: for optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



VOLTAGE NOTES

1. DC VOLTAGES MEASURED WITH 11 MEGOHM MULTIMETER
REFERENCED TO G.—

REFERENCES TO BE ADDED

2. VOLTAGE KEYS
DET. CARRIER AND PL TONE DETECTED

NO PL TONE DETECTED

TX	RADIO KEYED
RX	RADIO NOT KEYED

REVERSE BURST (150 MSEC AFTER TQ)

3. Q11 COLLECTOR VOLTAGE MEASURED WITH MICROPHONE

ON-HOOK AND MONITOR SWITCH IN PL POSITION

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81039E75-0	MITREK Two-Way FM Radio 146-174 MHz, 75/110 Watts
68P81045E70-0	MITREK Two-Way FM Radio 136-174 MHz, 40/60/75/110 Watts

REVISION DETAILS:**INSTRUCTION MANUAL 68P81039E75-0**

Replace 75/110 Watt Power Amplifier section 68P81040E53-0 with attached updated issue "-B".

INSTRUCTION MANUAL 68P81045E70-0

1. On page v, replace the power amplifier model chart EPS-29765-0 with the following issue "-A". (See model chart on page 2.)

2. Replace 75/110 Watt Power Amplifier section 68P81040E53-A with attached updated issue "-B".

ATTACHMENT:

HLD1031A/HLD1032A Power Amplifier Section

68P81040E53-B

MITREK MOBILE RADIO

POWER AMPLIFIER

136-174 MHz

40, 60, 75 AND 110 WATT

RF POWER

MODEL	DESCRIPTION
HLD1001A	POWER AMPLIFIER, R1 (40 WATT)
HLD1002A	POWER AMPLIFIER, R2 (40 WATT)
HLD1011A	POWER AMPLIFIER, R1 (60 WATT)
HLD1012A	POWER AMPLIFIER, R2 (60 WATT)
HLD1031A	POWER AMPLIFIER, R1 (75/110 WATT)
HLD1032A	POWER AMPLIFIER, R2 (75/110 WATT)

LEGEND:

● = ONE ITEM SUPPLIED

ITEMS	DESCRIPTION
HLD4011B	POWER AMPLIFIER BOARD, R1 (40 WATT)
HLD4012A	POWER AMPLIFIER BOARD, R2 (40 WATT)
HLD4021B	POWER AMPLIFIER BOARD, R1 (60 WATT)
HLD4022A	POWER AMPLIFIER BOARD, R2 (60 WATT)
HLD4041A	POWER AMPLIFIER BOARD, R1 (75/110 WATT)
HLD4042A	POWER AMPLIFIER BOARD, R2 (75/110 WATT)
HLD4063A	POWER TRANSISTOR KIT (40/60 WATT)
HLD4061A	POWER TRANSISTOR KIT (40 WATT)
HLD4067A	POWER TRANSISTOR KIT (75/110 WATT)
HLN4021A	FEED-THRU PLATE
HLN4046A	FEED-THRU PLATE
HLN4079A	HARDWARE LOW-POWER, R1
HLN4002A	HARDWARE KIT (40 WATT)
HLN4080A	HARDWARE LOW-POWER, R1
HLN4003A	HARDWARE KIT, R2 (60 WATT)
HLN4004A	HARDWARE KIT, R1 (75/110 WATT)
HLN4005A	HARDWARE KIT, R2 (75/110 WATT)
HLN4016A	ANTENNA SWITCH, LO-POWER
HLN4041A	ANTENNA SWITCH, HI-POWER

EPS-29765-A

OPTIONS

Time-Out Timer HLN4012A

RF Preamplifier HLD4051A (136-146 MHz)

RF Preamplifier HLD4052A (146-174 MHz)

Busy Light HLN4119A and Applicable Control Head

Handset TMN6057A and Handset Hang-Up Box TLN4698A

Microphone Hang-Up Box with Monitor Switch HLN4025A

Handset Hang-Up Box with Monitor Switch TLN4507A

Positive ground Cable Kits

Optional 10 and 22 Foot Cable Kits

Ignition Sense Lead HKN4007A

Non Weather-Resistant Control Head HCN4004/5/8-11A

Non Weather-Resistant Microphone HMN4001A

Full Line of SYSTEMS 90 Control Group Options

SYSTEMS 90 Control Cables

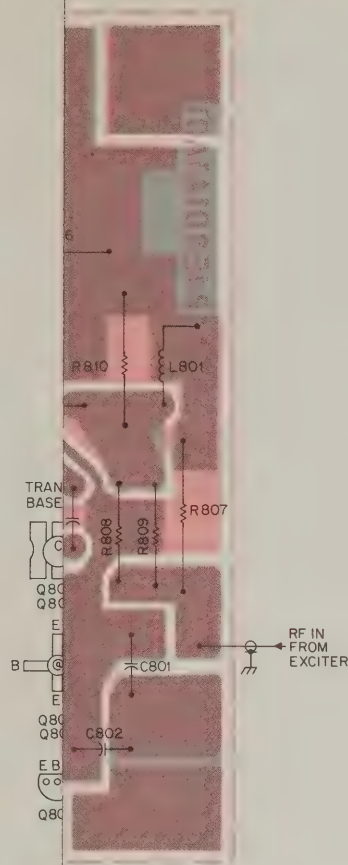
75/110 W POWER AMPLIFIER

MODELS HLD1031A (136-146 MHz)
AND HLD1032A (146-174 MHz)

CUR
SEN

TEMPERAT
SENSE

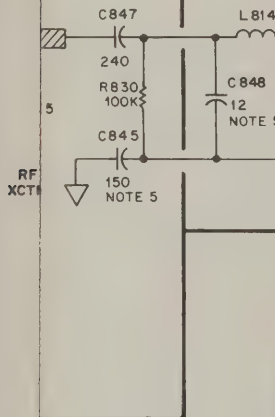
A + RE
VOLTAGE



FUNCTION

Increases power output of radio to 75 or 110 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

COMPONENT SIDE
SOLDER SIDE
BD - EEPS-26804-A
BD - EEPS-26805-A
OL - EEPS-26806-B



PARTS LIST SHOWN ON BACK

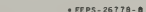
68P81040E53-B

10/23/80-PHI

POWER AMPLIFIER

MODELS HLD1031A (136-146 MHz)
AND HLD1032A (146-174 MHz)

Increases power output of radio to 75 or 110 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.



parts list

Legend		
L = 136-146 MHz		
H = 146-174 MHz		
HLN4004A Hardware Kit (136-146 MHz)		
HLN4005A Hardware Kit (146-174 MHz)		
HLD4041A Power Amplifier Board (136-146 MHz)		
HLD4042A Power Amplifier Board (146-174 MHz)		
HLD4067A Power Transistor Kit		
PL-6264-B		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed: pF ± 5%; 500 V; unless otherwise stated		
C801	21-963629	330 ± 10%; 600 V
C802	21-82372C10	.05 uF + 80-20%; 25 V
C803L	21-84493B59	39
C803H	21-83406D77	30
C804L	21-80067A57	62; 200 V
C804H	21-84493B59	39
C805L, 806L	21-84493B63	75
C805H, 806H	21-83406D77	30
C807L, 808L	21-84493B23	120; 200 V
C807H, 808H	21-84493B65	100
C809H	21-84493B66	150
C809L	21-84493B32	82; 200V
C810	21-83596E10	220 ± 20%
C811H, 812H	21-84493B63	75
C811L, 812L	21-84493B30	62; 200 V
C813L, 814L	21-82204B54	150; 200 V
C813H, 814H	21-84493B64	91
C816	8-84496D03	.01 uF ± 10%; 250 V
C817	21-83596E10	220 ± 20%
C818	8-82096J08	.022 uF ± 10%; 250 V
C819L thru 822L	21-83406D56	24
C819H thru 822H	21-84493B35	19
C823L, 824L	21-82610C20	82; 200 V
C823H, 824H	21-84715F26	55
C825H, 826H	21-80069B01	310; 350 V
C825L, 826L	21-80069B02	400; 350 V
C827, 828	21-82372C10	.05 uF + 80-20%; 25 V
C829	21-83596E10	220 ± 20%
C830H thru 833H	21-80169A74	60
C834H thru 837H	21-80169A74	50
C838L	21-84395B48	66; 250 V
C838H	21-84395B47	140; 350 V
C840	21-963629	330 ± 10%; 600 V
C842H	21-84395B40	70; 350 V
C842L	21-84366F08	40; 250 V
C843H	21-84395B41	19; 350 V
C843L	21-84366F21	10; 250 V
C845L	21-84395B35	240 ± 10%; 350 V
C845H	21-84395B46	150 ± 10%; 250 V
C847	21-84395B35	240 ± 10%; 350 V
C848L	21-84395B51	16; 250 V
C848H	21-84395B45	12; 350 V
C849L	21-84395B50	36; 250 V
C849H	21-84395B28	32; 350 V
C850L, 851L	21-84395B49	46; 250 V
C850H, 851H	21-84395B36	40; 350 V
C852L	21-84395B50	36; 250 V
C852H	21-84395B39	30; 350 V
C853L	21-84395B52	17; 250 V
C853H	21-84395B38	11; 350 V
C855, 856, 857	21-83596E10	220 ± 20%
C858	23-84538G04	15 uF ± 20%; 20 V
C859	8-82096J20	0.22 uF ± 10%; 250 V
C864	21-82187B07	.00047 uF ± 10%
C865	21-83596E10	220 ± 20%
C866L, 867L	21-84395B26	160 ± 2%
C869L	21-82372C10	.05 uF + 80-20%; 25 V
C869H	21-83406D69	30
C870	21-83596E10	220 ± 20%
C871L	21-84366F06	45; 250 V
C872L	21-83406D81	20
C873L	21-83406D70	8
C874L	21-84366F06	45; 250
C875	23-84669A06	60 uF; 25 V
diode: (see note)		
CR801, 803, 804	48-82466H13	silicon
coil:		
L801L	24-83884G08	5-1/2 turns
L801	24-83884G01	3-1/2 turns
L802	24-82723H27	choke; 1.2 uH
L803	24-80038A02	choke; ferrite 1/2 turn
L804	24-80277A01	12.5 turns
L805H	7-80062B02	1/2 turn; stamped
L805L	7-80062B04	1/2 turn; stamped
L806, 807	24-80036A02	choke; ferrite 1/2 turn
L808	24-80277A05	1.5 turns
L809, 810	24-82723H27	choke; 1.2 uH
L811	24-80277A04	7.5 turns
L812L	7-80062B02	1/2 turn; stamped
L812H	7-80062B04	1/2 turn; stamped

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L813	24-80277A08	1.5 turns
L814	24-80277A09	6.5 turns
L815 thru 818	24-80277A02	6.5 turns
L820	24-82723H24	choke; 0.14 uH
L821	24-80036A02	choke; ferrite 1/2 turn
transistor: (see note)		
Q801	48-869880	NPN; type M9860 (HLD4067A)
Q802	48-869583	NPN; type M9583 (HLD4067A)
Q803, 804	48-84411L04	NPN; type M1104 (HLD4067A)
Q805	48-869643	PNP; type M9643
resistor, fixed; ± 5%; 1/4 W; unless otherwise stated		
R801	17-80165C01	.01; 10 W
R802	6-11009C51	1.2k
R803	6-11009C41	470
R804	6-11009C56	2k
R806	6-11009C53	220
R807L	6-125A31	180; 1/2 W
R807H	6-125A41	470; 1/2 W
R808L, 809L	6-11009C20	62
R808H, 809H	6-124A09	22
R810L	6-125A31	180; 1/2 W
R810H	6-125A41	470; 1/2 W
R811H	6-125C01	10 ± 10%; 1/2 W
R811L	6-125D70	1 ± 10%; 1/2 W
R812H	6-127C17	47 ± 10%; 2 W
R812L	6-127C01	10 ± 10%; 2 W
R813	17-82038G07	1.5; 2 W
R814	6-125B61	4.7; 1/2 W
R815, 816	6-125C03	12 ± 10%; 1/2 W
R817, 818	17-82036G11	33 ± 10%; 2 W
R819	6-127C01	10 ± 10%; 2 W
R822	17-82291B24	0.1; 3 W
R823	6-11009C42	510
R824	6-11009C91	56k
R825	6-11009C37	330
R826	18-80268B03	variable; 10k
R827	6-125B61	4.7; 1/2 W
R830	6-11009C97	100k
R831L	6-125C25	100 ± 10%; 1/2 W
thermistor: 100 @ 25°C		
RT801	6-83600K09	
mechanical parts		
7-80078A01 BRACKET, thermistor mounting		
15-80053B01 COVER, HF shield		
32-80080A01 GASKET, antenna connector		
15-80135A01 HOUSING (75/110 W models)		
14-80143A04 INSULATOR, HI band		
3-10905A01 SCREW, machine (M3X0.5 x 6) 4 used		
2-7003 NUT, 8-32 x 5/16 x 1/8 hex; 2 used		
3-10922A06 SCREW, tapping (M3.5 x 1.27 x 8); 8 used		
3-10904A02 SCREW, machine (M3.5 x 0.6 x 6) 3 used		
2-80006A01 NUT, spanner		
4-114522 LOCKWASH, antenna switch		
29-80014A01 CLIP, coaxial; 2 used		
26-80070B01 SHIELD PA		
3-10905A05 SCREW, machine (M3 x 0.5 x8) 4 used		
26-80052B01 HF SHIELD		
4-80207C01 SHOULDER, washer; 2 used		
14-80206C01 SILICON insulator		
26-80205C01 HEATSINK bracket		



MOTOROLA INC.

**Communications
Group**

instruction manual revision

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct your manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81045E70-O MITREK Two-Way FM Radio, 136-174 MHz, 40/60/75/110 Watts

REVISION DETAILS:

1. Please add the attached page v and vi from your manual and delete the present page v and vi.
2. Please insert the attached Instruction Section 68P80100W07-0 to your manual after Instruction Section 68P81039E31-D

1 of 1

technical publication services

Address inquiries to:
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Fort Worth, Texas 76137
Attn:- Technical Publication Services

WMR-0021

8/1/82-TP

MODEL NUMBER	DESCRIPTION
HLD1001A	POWER AMPLIFIER, 40W (136-146 MHz)
HLD1002A	POWER AMPLIFIER, 40W (146-174 MHz)
HLD1002B	POWER AMPLIFIER, 40W (146-174 MHz)
HLD1011A	POWER AMPLIFIER, 60W (136-146 MHz)
HLD1012A	POWER AMPLIFIER, 60W (146-174 MHz)
HLD1031A	POWER AMPLIFIER, 75/110W (136-146 MHz)
HLD1032A	POWER AMPLIFIER, 75/110W (146-174 MHz)

● = ONE ITEM SUPPLIED

										ITEM	DESCRIPTION
										HLD4011B	PA BOARD, 40W (136-146 MHz)
										HLD4012A	PA BOARD, 40W (146-174 MHz)
										HLD4021B	PA BOARD, 60W (136-146 MHz)
										HLD4022A	PA BOARD, 60W (146-174 MHz)
										HLD4041A	PA BOARD, 75/110W (136-146 MHz)
										HLD4042A	PA BOARD, 75/110W (146-174 MHz)
										HLD4124A	PA BOARD (146-174 MHz)
										HLD4061A	TRANSISTOR KIT, 40W
										HLD4063A	TRANSISTOR KIT, 40/60W
										HLD4067A	TRANSISTOR KIT, 75/110W
										HLD4125A	TRANSISTOR KIT 40W
										HLN40021A	FEED-THRU PLATE
										HLN4046A	FEED-THRU PLATE
										HLN4079A	PA HARDWARE KIT, 40W (136-146 MHz)
										HLN4002A	PA HARDWARE KIT, 40W (146-174 MHz)
										HLN4002B	PA HARDWARE KIT, 40W (146-174 MHz)
										HLN4080A	PA HARDWARE KIT, 60W (136-146 MHz)
										HLN4003A	PA HARDWARE KIT, 60W (146-174 MHz)
										HLN4005A	PA HARDWARE KIT, 75/110W (136-174 MHz)
										HLN4016A	ANTENNA SWITCH
										HLN4041A	ANTENNA SWITCH, HI-POWER

OPTIONS

Handset TMN6057A and Handset Hang-Up Box TLN4698A
Microphone Hang-Up Box with Monitor Switch HLN4025A
Handset Hang-Up Box with Monitor Switch TLN4507A

Non-Weather-Resistant Control Head HLN4004, 4005, 4008–4011A
Non-Weather-Resistant Microphone HLN4001A

v

SPECIFICATIONS

GENERAL

Dimensions	40/60 W; 6.35 cm x 25.4 cm x 30.48 cm (2.5" x 10" x 12") 75/110 W; 6.35 cm x 25.4 cm x 36.9 cm (2.5" x 10" x 14.5")
Frequency Range	146-174 MHz
Weight (Less Acc)	40/60 W; 4.76 kg (10.5 pounds) 75/110 W; 6.24 kg (13.75 pounds)
Temperature Range	-30 to +60°C
No. of Frequencies	1 to 4
Polarity	+/-Ground

CURRENT REQUIREMENTS

Standby	.45 A (@13.8 V)
Receiver	2.25 A (@13.8 V)
Transmitter (40 W)	10 A (@13.6 V)
(60 W)	17 A (@13.6 V)
(75 W)	22 A (@13.4 V)
(110 W)	27 A (@13.4 V)

TRANSMITTER

Power Out	40/60 W and 75/110 W
Stability	5 PPM
Distortion	3%
FM Noise	70 dB
Spurs	85 dB
Freq. Separation	3.0 MHz

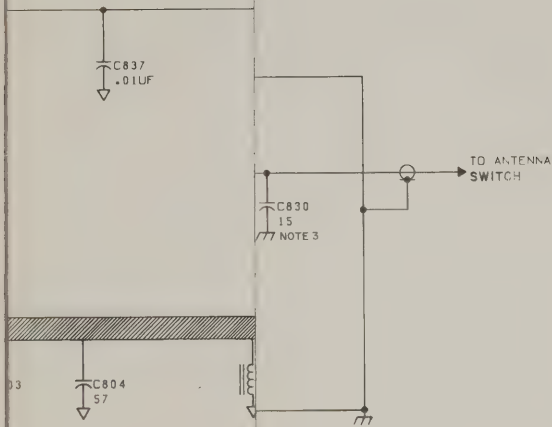
RECEIVER

Sensitivity	0.5 uV (0.25 uV with optional preamp)
Intermodulation	85 dB (80 dB with optional preamp)
Selectivity	95 dB (30 kHz) 90 dB (25 kHz)
Stability	5 PPM
Modulation Acceptance	± 7 kHz
Spurs	100 dB
Audio Power	8 Watts
Distortion	5%
Freq. Separation	2 MHz

"Mitrek", "Private-Line", "Digital Private-Line", and Systems•90 are trademarks of Motorola, Inc.

40-WATT MITREK POWER AMPLIFIER

MODELS HLD1001A (136-146 MHz)
AND HLD1002B (146-174 MHz)



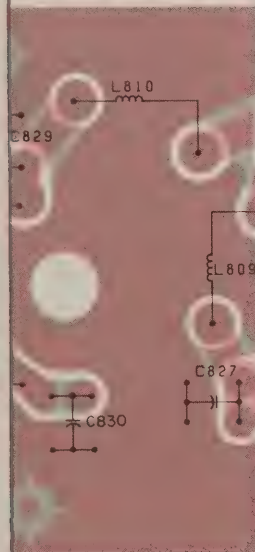
FUNCTION

Increases power output of radio to 40 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

NOTE

The power level can be adjusted from 30-40 watts on the 136-146 MHz models.

EEPW-0079-0



VERSION
A (136-146 MHz)
A (146-174 MHz)

SHOWN F

68P80100W07-O
8/1/82-TP

SPECIFICATIONS

GENERAL

Dimensions	40/60 W; 6.35 cm x 25.4 cm x 30.48 cm (2.5" x 10" x 12") 75/110 W; 6.35 cm x 25.4 cm x 36.9 cm (2.5" x 10" x 14.5")
Frequency Range	146-174 MHz
Weight (Less Acc)	40/60 W; 4.76 kg (10.5 pounds) 75/110 W; 6.24 kg (13.75 pounds)
Temperature Range	-30 to +60°C
No. of Frequencies	1 to 4
Polarity	+/-Ground

CURRENT REQUIREMENTS

Standby	.45 A (@13.8 V)
Receiver	2.25 A (@13.8 V)
Transmitter (40 W)	10 A (@13.6 V)
(60 W)	17 A (@13.6 V)
(75 W)	22 A (@13.4 V)
(110 W)	27 A (@13.4 V)

TRANSMITTER

Power Out	40/60 W and 75/110 W
Stability	5 PPM
Distortion	3%
FM Noise	70 dB
Spurs	85 dB
Freq. Separation	3.0 MHz

RECEIVER

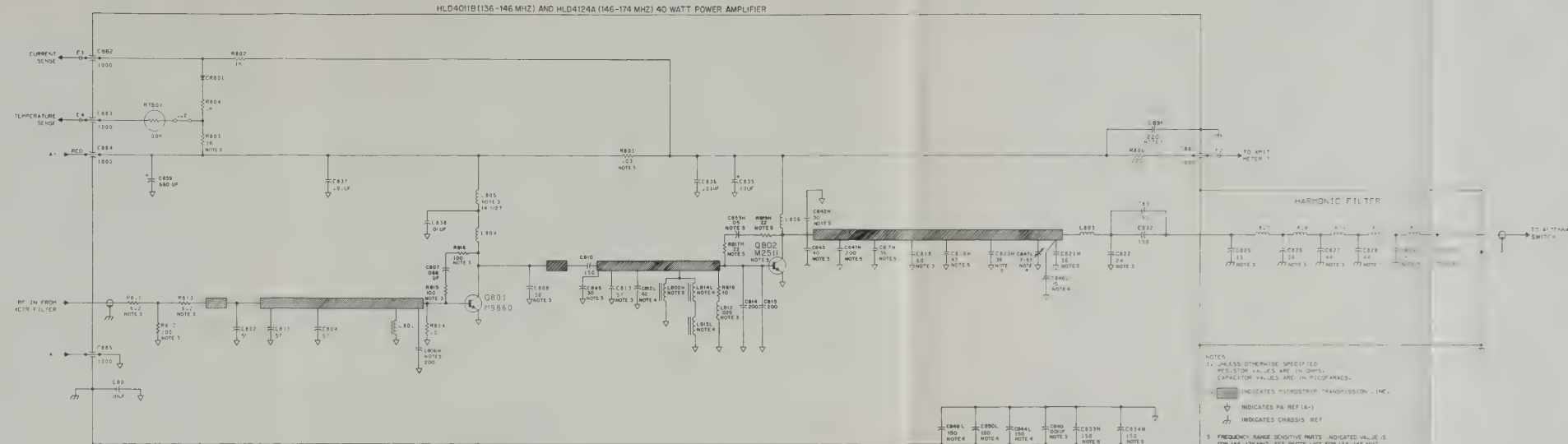
Sensitivity	0.5 uV (0.25 uV with optional preamp)
Intermodulation	85 dB (80 dB with optional preamp)
Selectivity	95 dB (30 kHz) 90 dB (25 kHz)
Stability	5 PPM
Modulation Acceptance	± 7 kHz
Spurs	100 dB
Audio Power	8 Watts
Distortion	5%
Freq. Separation	2 MHz

"Mitrek", "Private-Line", "Digital Private-Line", and Systems•90 are trademarks of Motorola, Inc.

parts list

Legend:		
L = 136-146 MHz H = 146-174 MHz		
HLD4011B Power Amplifier (136-146 MHz)		
HLD4124A Power Amplifier (146-174 MHz)		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed; pF, $\pm 5\%$: unless otherwise stated
C801	21-83596E36	.01 μF = 50%, -40%
C802L	21-84493B27	51; 200 V
C802H	21-83406D92	36; 200 V
C803L	21-80169A55	57; N150
C803H	21-83406D92	36; 200 V
C804	21-80169A55	57; 200 V
C807	8-63813H23	.008 μF ; 50 V
C808L	21-83406D56	24; 500 V
C808H	21-80171A45	30; 500 V
C810L	21-82204B54	150
C810H	21-82187B49	150; 500 V
C812L, 813L	21-84493B30	62
C812H		NOT USED
C813H	21-80169A55	57
C817L		NOT USED
C817H	21-83406D92	36; 500 V
C818L	21-84395B26	160 $\pm 2\%$
C818H	21-84395B07	60; 250 V
C819L		NOT USED
C819H	21-83406D87	40; 500 V
C820L, 821L		NOT USED
C820H, 821H	21-83406D92	36; 500 V
C822L	21-83406D92	10; ± 0.5 pF
C822H	21-83406D56	24; 500 V
C825L	21-84395B42	18.5
C825H	21-84395B16	15; 850 V
C826L	21-84395B43	38
C826H	21-84395B17	36; 850 V
C827L, 828L	21-84395B44	48
C827H, 828H	21-84395B18	44; 850V
C829L	21-84395B43	38
C829H	21-84395B17	36; 850 V
C830L	21-84395B42	18.5
C830H	21-84395B16	15; 850 V
C831, 832	21-82187B49	150; 500V
C833L		NOT USED
C833H	21-82187B49	150; 500 V
C834L		NOT USED
C834H	21-82187B49	150; 500 V
C835	23-82783B27	10 μF ; 25 V
C836, 837, 838	21-83596E36	.01 μF = 60%, -40%, 200 V
C839	21-83210A22	660 μF + 150%, -10%; 25 V
C840L	21-82204B54	150
C840H	21-83596E13	.001 μF ; 1000 V
C844L	21-82204B54	150
C844H		NOT USED
C845L	21-83406D71	33
C845H	21-83406D69	30
C849H, 847H		NOT USED
C846L	21-83406D97	15
C847	20-84578B11	variable; 7-57 pF
C848L, 850L	21-82204B54	150; 500 V
C891L	21-82187B49	150; 500 V
C891H	21-83596E10	00022 $\pm 20\%$; 500 V
		diode (see note):
CR801	48-82466H13	silicon
		coil:
L801	24-80036A02	fermite; $\frac{1}{2}$ turn
L802L		NOT USED
L802H	24-83977B02	fermite; 2- $\frac{1}{2}$ turns
L803	24-84614A05	1- $\frac{1}{2}$ turns
L804	24-83884G06	4- $\frac{1}{2}$ turns; molded
L805L	24-83884G08	5- $\frac{1}{2}$ turns; molded
L805H	24-84411B02	14- $\frac{1}{2}$ turns; molded
L806	24-83547G10	2- $\frac{1}{2}$ turns
L807L, 808L	24-80066A03	6- $\frac{1}{2}$ turns
L807H, 808H	24-80066A01	6- $\frac{1}{2}$ turns
L809L	24-80066A04	5- $\frac{1}{2}$ turns
L809H	24-80066A02	5- $\frac{1}{2}$ turns
L810L, 811L	24-80066A03	6- $\frac{1}{2}$ turns
L810H, 811H	24-80066A01	6- $\frac{1}{2}$ turns
L812L	24-82723H04	290 nH
L812H	24-82723H26	.029 μH
L813L	24-80036A02	fermite; $\frac{1}{2}$ turn
L813H		NOT USED
L814L	24-82723H04	290 nH
L814H		NOT USED

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R801L	17-80233B01	resistor, fixed; $\pm 5\%$, $\frac{1}{2}$ W;
R801H	17-80233B02	.02; 5 W
R802, 803H, 804	6-124A49	1k
R803L	6-124A45	860
R806	6-124C33	220 $\pm 10\%$
R811L	6-125A01	10; $\frac{1}{2}$ W
R811H	6-125B64	6.2; $\frac{1}{2}$ W
R812L	6-125A04	81; $\frac{1}{2}$ W
R812H	6-125A32	200; $\frac{1}{2}$ W
R813L	6-125A01	10; $\frac{1}{2}$
R813H	6-125B64	6.2; $\frac{1}{2}$ W
R814	6-124A01	10
R815L, 816L	6-125A11	27; $\frac{1}{2}$ W
R815H, 816H	6-124A25	100
R818	6-125C01	10 $\pm 10\%$; $\frac{1}{2}$ W
thermistor:		
RT801	6-83600K09	100k $\pm 25\%$
mechanical parts		
E802, 803	29-80014A01	CLIP, coax (terminal)
	42-10217A26	TIE STRAP, for C839
HLD4021A Feed-thru Plate		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C81 thru 885	21-82812H03	capacitor, 1000 ± 100 , $\pm 0\%$; 500 V
mechanical parts		
64-80005A01		PLATE, feed-thru
4-83755H01		WASHER, solder
HLD4003A Power Transistor Kit (40 W; 136-146 MHz) (80 W; 136-174 MHz)		
HLD4125A Power Transistor Kit (40 W; 146-174 MHz)		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q801	48-869860	transistor (see note):
Q802L	48-84411L04	NPN; type M9860
Q802H	48-80225C11	NPN; type M2511
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers		
HLD4079A Power Amplifier Hardware Kit (136-146 MHz)		
HLD4003B Power Amplifier Hardware Kit (146-174 MHz)		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C814, 815, 806H	21-84366F12	capacitor, fixed; $\pm 5\%$, 250 V;
C841L		200 $\pm 10\%$; 500 V
C842H, 843L	21-84366F22	50
C843H	21-84366F08	40
C853H	21-82372C10	.05 μF $\pm 20\%$
resistor, fixed:		
R817H, 819H	6-125A09	22 $\pm 5\%$; $\frac{1}{2}$ W
mechanical parts		
2-7023		NUT, 8-32 x $\frac{5}{16}$ x $\frac{1}{16}$ " for Q801;
3-10905A01		SCREW, machine (M3 x 0.5 x 6) for harm.
		fil. and brkt.
3-10905A05		SCREW, machine (M3 x 0.5 x 8) for Q802;
		2 used
3-10936A06		SCREW, tapping (B3.5 x 1.27 x 8); 7 used
4-7666		WASHER, lock; 7 used
7-90078A01		BRACKET, thermistor
7-90291A01		GROUND BRACKET, harmonic filter
14-80077A01		INSULATOR, PA compartment
antenna switch mounting parts		
2-80005A01		NUT, spacer
4-114522		WASHER, lock, $\frac{1}{8}$ int
32-80080A01		GASKET
feed thru plate		
3-10904A02		SCREW, machine (M3.5 x 0.6 x 6); 3 used



40-WATT MITREK POWER AMPLIFIER

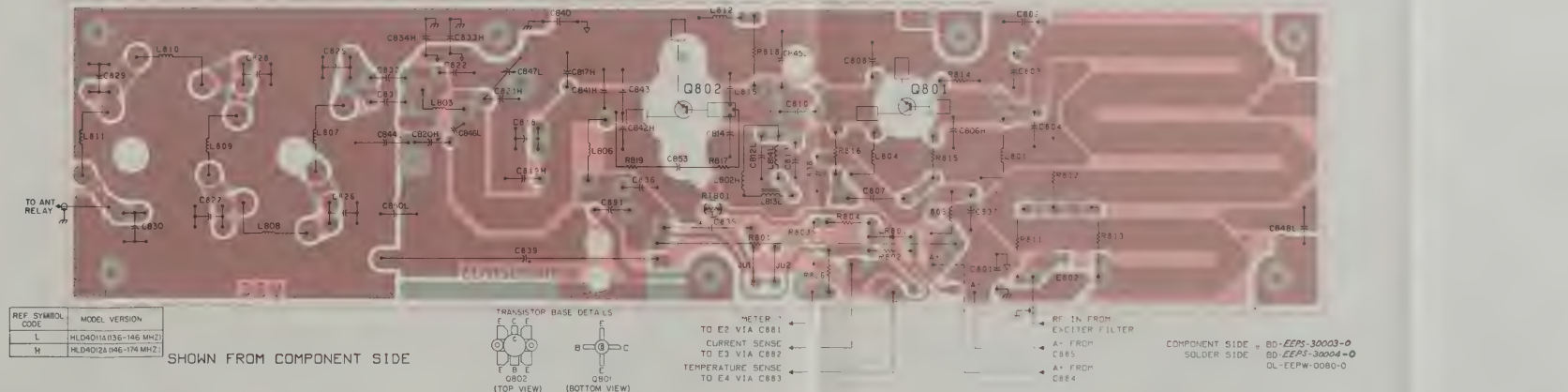
MODELS HLD1001A (136-146 MHz)
AND HLD1002B (146-174 MHz)

FUNCTION

Increases power output of radio to 40 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

NOTE

The power level can be adjusted from 30-40 watts on the 136-146 MHz models.



GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81037E75-B	MITREK Two-Way FM Radio 403-420 MHz and 450-512 MHz, 30/50 W
68P81045E65-0	MITREK Two-Way FM Radio 29.7-50 MHz 60/110 W
68P81045E70-0	MITREK Two-Way FM Radio 136-174 MHz 40/60/75/110 W
68P81045E75-0	MITREK Two-Way FM Radio 406-420 MHz and 450-512 MHz, 30/50/75/100 W
68P81045E80-0	MITREK Two-Way FM Radio 806-870 MHz 12/35 W

REVISION DETAILS:

Please make the following correction to Parts List PL-6050-D which is part of Instruction section 68P81039E23-E, DIGITAL PRIVATE-LINE Encoder/Decoder, Model HLN4011A. The part number for diode CR5 is incorrectly shown and should read 48-82466H13 instead of 48-82466H01.



instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81045E65-0	MITREK Two-Way FM Radio, 29.7-50 MHz
68P81045E70-0	MITREK Two-Way FM Radio, 136-174 MHz
68P81045E75-0	MITREK Two-Way FM Radio, 406-420 MHz and 450-512 MHz; 30/50 Watts and 75/100 Watts
68P81037E75-B	MITREK Two-Way FM Radio, 403-420 MHz and 450-512 MHz; 30/50 Watts

REVISION DETAILS:

Please add the following parts list (PL-7223) to the MITREK Accessories instruction section (68P81039E26) in your servicing manual.

parts list

HSN4002A Speaker (with Systems 90) PL-7223-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
LS301	50-84561B02	speaker: dia. 5"; PM
		mechanical parts
	18-0701T24	CABLE
	18-0705T21	HARDWARE, mounting
	3-140001	SCREW, tapping; 6-19 x 7/8"; 4 used
	38-4244C01	SCREW, wing; 2 used
	78-4568B01	BRACKET, trunnion
	13-82671M01	BEZEL, speaker
	15-84981B01	COVER, speaker base
	32-84564B01	GASKET, speaker
	50-84561B02	SPEAKER, 5" dia.; PM



MOTOROLA INC.

**Communications
Group**

instruction manual revision

WARNING

This revision contains **important safety information**. Please insert it inside the front cover of your manual as soon as possible.

INSTRUCTION MANUALS AFFECTED:

68P81037E75-B	MITREK 403-420, 450-512 MHz; 30/50 Watts
68P81039E80	(Supplement to 68P81037E75) MITREK 450-512 MHz; 75/100 Watts
68P81043E40-A	SYNTOR 136-174 MHz; 40/75/110 Watts
68P81043E45-O,A	SYNTOR 403-512 MHz; 30/50/75/100 Watts
68P81045E65-O	MITREK 29.7-50 MHz; 60/110 Watts
68P81045E70-O	MITREK 136-174 MHz; 40/60/75/110 Watts
68P81045E75-O	MITREK 406-420 and 450-412 MHz; 30/50/75/100 Watts
68P81045E80-O	MITREK 806-825 MHz Transmit; 851-870 MHz Receive; 12/35 Watts
68P81060E05-O	SYNTOR X 150-174 MHz; 110 Watts
68P81108E05	Electronic Siren and Public Address System

TEXT OF REVISION:

WARNING: It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard.

National Fire Protection Association standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicles. This standard requires that:

1. Any space containing radio equipment shall be isolated by a seal from the space in which the LP-gas container and its fittings are located.
2. Remote (outside) filling connections shall be used.
3. Venting of the container space to the outside shall be provided.

1 of 1

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WMR-0005
8/1/82-TP

general

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

instruction manual affected:

68P81045E70-O

"MITREK" Two-Way FM Radio 136-174 MHz

revision details:

In section 68P81039E29-C replace Sheet 3 of 5 with this Sheet 3 of 5.

DO NOT DISCARD THE EXISTING DIAGRAM IN YOUR MANUAL. THE SCHEMATIC DIAGRAM ON THE FRONT IS STILL APPLICABLE.

HIGH BAND MITREK RADIO

RECEIVER SECTION BOARD DETAIL

parts list

HLN4044A Interconnect Board

PL-6030-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2	23-83210A19	capacitor, fixed: 500 uF + 100-10%; 20 V 4.7 uF ± 10%; 25 V 470 pF ± 20%; 25 V (feed thru)
C3	23-82783B25	
C11 thru 29	21-84874K01	
CR1	48-82525G19	diode: (see note) silicon silicon silicon silicon
CR2	48-83654H01	
CR3	1-80701T76	
CR4	48-82466H18	
J1	1-80701T74	connector, receptacle: connector, assembly; includes C11-C29 female; 9 contact female; 25 contact
J3	9-80180B02	
J10	9-80180B03	
R2	6-124C55	resistor, fixed: 1.8k ± 10%; 1/4 W 220 ± 10%; 1/4 W
R4	6-124C33	
mechanical parts		
	42-80088A01	CLIP, option

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

parts list

HLN4119A Busy Light Adapter Board

PL-6323-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C460	23-84665F01	capacitor, fixed: 10 uF
L460		
		choke: 0.41 uH
R460	6-124A67	resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R461	6-124A56	
R462	6-124A49	
R463	6-124A61	
R464	6-124A65	
R465	6-124A49	
R466	6-124A71	
R467	6-124A66	
R468	6-124A49	
R469	6-124A65	
R470	6-124A66	
R471	6-124A25	
CR460 thru 462	48-83654H02	diode: (see note) silicon
		transistor: (see note)
Q460	48-869642	NPN; type M9642
Q461	48-869643	PNP; type M9643
Q462	48-869642	NPN; type M9642
Q463	48-869643	PNP; type M9643

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

68P81039E29-D

(Sheet 3 of 5)

8/1/82-TP

P/O HLD4001A Main Board Receiver Se
P/O HLD4002A Main Board Receiver Se

REFERENCE SYMBOL	MOTOROLA PART NO.
C1	23-84665F04
C2	23-84665F01
C3	23-84538G04
C4	21-84493B41
C101	21-83596E10
C103	21-84493B41
C104	21-84494B07
C105	21-80169A55
C106	21-83406D90
C107	21-82610C03
C108	23-84538G02
C109	21-83596E36
C110	21-82450B17
C111	21-83596E10
C112H	21-80169A24
C112L	21-83406D83
C116H	21-80169A24
C116L	21-83406D83
C117	21-83596E10
C118	21-82372C10
C119	21-83596E10
C120	21-80067A30
C121H	21-83406D66
C121L	21-82610C94
C122H	21-82204B75
C122L	21-84493B43
C123, 124	21-83596E36
C133	21-80169A24
C134	21-83596E10
C136	21-83596E10
C138	8-84637L02
C139	
C140H	21-830201
C140L	21-842041
C141H	21-80067A12
C141L	21-83406D84
C202	21-82372C10
C203	21-83406D87
C204	21-83406D56
C205, 206	21-82372C10
C208	21-83406D68
C209	21-83406D56
C210	21-80067A57
C213	21-82450B04
C214	21-80169A55
C215	21-80171A61
C216	21-82372C10
C218	21-82187B44
C219	23-84538G02
C220	21-82372C10
C222	21-82204B68
C223	21-80171A61
C227	21-82450B55
C228	21-83406D85
C229	21-82204B41
C230	21-82372C10
C231	21-83596E36
C232	21-82450B46
C233	21-83596E38
C234	21-80169A55
C237	21-83596E38
C238	21-82372C10
C239	8-84637L02
C240	8-84637L30
C412	8-84637L37
C414	8-84637L31
C415	21-84494B15
C416	23-84538G04
C417	23-84538G02
C418	23-84665F01
C419	8-84637L28
C420	8-84637L27
C421	8-84637L02
C422	23-84665F01
C423	8-84637L32
C424	8-84637L24
C425	8-84637L25
C426	8-84637L26
C427, 428	23-84538G04
C431	23-84665F01
C432	23-84665F06
C433, 434	8-84637L33
C435, 436, 437	21-83596E10
C440	8-84637L27
C441, 450	23-84665F01
C451	21-83596E10
C499	21-82187B44
CR1,2	48-83654H01
CR101	48-83654H01
CR102	48-82139G01
CR401	48-83654H01
CR403 thru 406	48-83654H01
CR605 thru 612	48-83654H01
J1001	9-82748G01

PL-6036

DESCRIPTION

1ed:
2%; 500 V
1%; 500 V
1pF; 500 V
5%; 500 V
1
4%; 500 V
4
ceptacle:
contacts
2
2
9
1
goded grn)
1
ee note)
type M9639
2
1d:
4 W

RD INDICATES
DR
ELECTROLYTIC

ADAPTER BOARD

SIDE

SOLDER SIDE - BD-1
COMPONENT SIDE - BD-1
OL-1

Q404
Q101, Q901
Q904, Q1006
Q703
Q704
OTHERS
TRANSISTOR BASE
DETAILS
BOTTOM VIEW

WAVEFORM
SEE
FIGURE

EEPS-29773-0
EEPS-29774-0
EEPS-27406-B
EEPS-27412-0

TED
N USED.



MOTOROLA INC.

**Communications
Group**

MITREK TWO-WAY FM RADIO

136-174 MHz
40/60/75/110 WATTS

<i>SECTION</i>	<i>NUMBER</i>
OPERATION	Inside Cover
Radio Set Model Chart	Page iii
Unified Chassis Breakdown	Page iii, iv
PA Breakdown and Options Chart	Page v
Specifications	Page vi
Foreword	Pages vii, viii
GENERAL SAFETY INFORMATION	68P81045E71
INSTALLATION	68P81109E32
Installation Considerations	(Sheet 1 of 2)
Installation Procedures	(Sheet 2 of 2)
THEORY OF OPERATION	Page 1
General	Page 1
Meter 4 Circuit	Page 1
Power Control and Protection Circuit	Page 1
Bridge Audio Circuit	Page 2
MAINTENANCE	Page 3
General	Page 3
Radio Set Disassembly	Page 3
Power Amplifier	Page 4
High Power PA Field Repair Failure Analysis	Page 4
Ignition Noise and Anti-Skid Braking	Page 4
ALIGNMENT	
Test Equipment and Receiver Alignment	PEPS-26663
Transmitter Alignment	PEPS-26662
INSTRUCTION SECTIONS	
Functional Block Diagram	Page 7
Transmitter Section and Time-Out Timer Parts Lists and Circuit Board Details	68P81039E29 (Sheet 1 of 5)
Transmitter Section Schematic Diagram	68P81039E29 (Sheet 2 of 5)
Receiver Section, Busy Light, and Interconnect Board Circuit Board Details	68P81039E29 (Sheet 3 of 5)
Receiver Section, Busy Light, and Interconnect Board Schematic Diagrams	68P81039E29 (Sheet 4 of 5)
Radio Set Mechanical Parts	68P81039E29 (Sheet 5 of 5)
Lock Removal Procedure	68P81039E29 (Sheet 5 of 5)
40 Watt Power Amplifier, Instruction Section	68P81039E31
60 Watt Power Amplifier, Instruction Section	68P81039E32
75 or 110 Watt Power Amplifier	68P81040E53



<i>SECTION</i>	<i>NUMBER</i>
OPERATION	Inside Cover
Radio Set Model Chart	Page iii
Unified Chassis Breakdown	Page iii, iv
PA Breakdown and Options Chart	Page v
Specifications	Page vi
Foreword	Pages vii, viii
GENERAL SAFETY INFORMATION	68P81045E71
INSTALLATION	6P81109E32
Installation Considerations	(Sheet 1 of 2)
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THEORY OF OPERATION	Page 1
General	Page 1
Meter 4 Circuit	Page 1
Power Control and Protection Circuit	Page 1
Bridge Audio Circuit	Page 2
MAINTENANCE	Page 3
General	Page 3
Radio Set Disassembly	Page 3
Power Amplifier	Page 4
High Power PA Field Repair Failure Analysis	Page 4
Ignition Noise and Anti-Skid Braking	Page 4
ALIGNMENT	
Test Equipment and Receiver Alignment	PEPS-26663
Transmitter Alignment	PEPS-26662
INSTRUCTION SECTIONS	
Functional Block Diagram	Page 7
Transmitter Section and Time-Out Timer Parts Lists and Circuit Board Details	68P81039E29 (Sheet 1 of 5)
Transmitter Section Schematic Diagram	68P81039E29 (Sheet 2 of 5)
Receiver Section, Busy Light, and Interconnect Board Circuit Board Details	68P81039E29 (Sheet 3 of 5)
Receiver Section, Busy Light, and Interconnect Board Schematic Diagrams	68P81039E29 (Sheet 4 of 5)
Radio Set Mechanical Parts	68P81039E29 (Sheet 5 of 5)
Lock Removal Procedure	68P81039E29 (Sheet 5 of 5)
40 Watt Power Amplifier, Instruction Section	68P81039E31
60 Watt Power Amplifier, Instruction Section	68P81039E32
75 or 110 Watt Power Amplifier	68P81040E53

SECTION

NUMBER

HLN4020A Tone “Private-Line” Encoder-Decoder, Instruction Section	68P81039E22
HLN4020A Tone “Private-Line” [®] Encoder-Decoder, Instruction Section	68P81039E22
HLN4011A Digital “Private-Line” Encoder-Decoder, Instruction Section	68P81039E23
TLN5730A Digital “Private-Line” Two-Code Adapter, Instruction Section	68P81106E97
MITREK [®] Accessories, Instruction Section	68P81039E26
MITREK Control Head and Cables, Instruction Section	68P81039E24

MODEL CHART

FOR

146-174 MHz

MITREK MOBILE RADIO

1-4 FREQUENCY

40, 60, 75 AND 110 W RF POWER

MODEL NUMBER	DESCRIPTION	RF OUTPUT	FREQ.
CARRIER SQUELCH			
T43JJA1000BK	RADIO SET	40 WATT	1
T43JJA1900BK	RADIO SET	40 WATT	4
T53JJA1000BK	RADIO SET	60 WATT	1
T53JJA1900BK	RADIO SET	60 WATT	4
T63JJA1000BK	RADIO SET	75 WATT	1
T63JJA1900BK	RADIO SET	75 WATT	4
T83JJA1000BK	RADIO SET	110 WATT	1
T83JJA1900BK	RADIO SET	110 WATT	4
"PRIVATE LINE"			
T43JJA3000BK	RADIO SET	40 WATT	1
T43JJA3900BK	RADIO SET	40 WATT	4
T53JJA3000BK	RADIO SET	60 WATT	1
T53JJA3900BK	RADIO SET	60 WATT	4
T63JJA3000BK	RADIO SET	75 WATT	1
T63JJA3900BK	RADIO SET	75 WATT	4
T83JJA3000BK	RADIO SET	110 WATT	1
T83JJA3900BK	RADIO SET	110 WATT	4
"DIGITAL PRIVATE LINE"			
T43JJA6000BK	RADIO SET	40 WATT	1
T43JJA6900BK	RADIO SET	40 WATT	4
T53JJA6000BK	RADIO SET	60 WATT	1
T53JJA6900BK	RADIO SET	60 WATT	4
T63JJA6000BK	RADIO SET	75 WATT	1
T63JJA6900BK	RADIO SET	75 WATT	4
T83JJA6000BK	RADIO SET	110 WATT	1
T83JJA6900BK	RADIO SET	110 WATT	4

LEGEND:

- = ONE ITEM SUPPLIED
- / = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- 2 = NUMBER INDICATES QUANTITY SUPPLIED
- = INDICATES BREAKDOWN ON SEPARATE CHART

ITEM	DESCRIPTION
■ HUD1001B	CHASSIS, 136-146 MHz (40 WATT)
■ HUD1002B	CHASSIS, 146-174 MHz (40 WATT)
■ HUD1011B	CHASSIS, 136-146 MHz (60 WATT)
■ HUD1012B	CHASSIS, 146-174 MHz (60 WATT)
■ HUD1031B	CHASSIS, 136-146 MHz (75/110 WATT)
■ HUD1032B	CHASSIS, 146-174 MHz (75/110 WATT)
HLN4020A	"PRIVATE-LINE" BOARD
HLN4011A	"DIGITAL PRIVATE-LINE" BOARD
TRN6005A	CODE PLUG
KLN6209A	"VIBRASPOUNDER" RESONANT REED
KXN1086B	CHANNEL ELEMENT, RECEIVER
KXN1088A	CHANNEL ELEMENT, TRANSMITTER
HHN4000A	HOUSING, TOP COVER LOW POWER
HHN4001A	HOUSING, TOP COVER HIGH POWER
HLN4034A	HOUSING, BOTTOM COVER
HCN4000A	CONTROL HEAD, 1-FREQ., CARRIER SQUELCH
HCN4001A	CONTROL HEAD, 4-FREQ., CARRIER SQUELCH
HCN4002A	CONTROL HEAD, 1-FREQ., "PRIVATE-LINE"
HCN4003A	CONTROL HEAD, 4-FREQ., "PRIVATE-LINE"
HMN4000A	MICROPHONE
HSN4000A	SPEAKER
HKN4000A	CABLE (17') 1-FREQ.
HKN4001A	CABLE (17') 4-FREQ.
HKN4016A	CABLE (17') 1-FREQ.
HKN4017A	CABLE (17') 4-FREQ.
HLN4024A	MICROPHONE HANG-UP BOX
TAD6111A	ANTENNA, ROOF TOP (136-144 MHz)
TAD6112A	ANTENNA, ROOF TOP (144-152 MHz)
TAD6113A	ANTENNA, ROOF TOP (152-162 MHz)
TAD6014A	ANTENNA, ROOF TOP (162-174 MHz)
HLN4022A	INSTALLATION KIT
HLN4023A	TUNING TOOL KIT
HKN4041A	FUSE LEAD

EPS-27385-A

MITREK MOBILE RADIO

136-174 MHz

40, 60, 75 AND 110 WATT

RF POWER

LEGEND:

● = ONE ITEM SUPPLIED

■ = SEE FURTHER BREAKDOWN IN THIS CHART

★ = SEE FURTHER BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION
■ HUD1001B	UNIFIED CHASSIS, 136-146 MHz (40 WATT) R1
■ HUD1002B	UNIFIED CHASSIS, 146-174 MHz (40 WATT) R2
■ HUD1011A	UNIFIED CHASSIS, (60 WATT) R1
■ HUD1012B	UNIFIED CHASSIS (60 WATT) R2
■ HUD1031B	UNIFIED CHASSIS, (110 WATT) R1
■ HUD1032B	UNIFIED CHASSIS (110 WATT) R2
HUD1003B	UNIFIED SUB CHASSIS
HUD1004B	UNIFIED SUB CHASSIS
HUD1013B	UNIFIED SUB CHASSIS
HUD1014B	UNIFIED SUB CHASSIS
HUD1033B	UNIFIED SUB CHASSIS
HUD1034B	UNIFIED SUB CHASSIS

MODEL	DESCRIPTION
■ HUD1003B	UNIFIED CHASSIS, VHF R1 (40 WATT)
■ HUD1004B	UNIFIED CHASSIS, VHF R2 (40 WATT)
■ HUD1013B	UNIFIED CHASSIS, VHF R1 (60 WATT)
■ HUD1014B	UNIFIED CHASSIS, VHF R2 (60 WATT)
■ HUD1033B	UNIFIED CHASSIS, VHF R1 (110 WATT)
■ HUD1034B	UNIFIED CHASSIS, VHF R2 (110 WATT)
HLN4189A	HARDWARE KIT, 136-174 MHz
★ HLD1001A	POWER AMPLIFIER, R1 (40 WATT)
★ HLD1002A	POWER AMPLIFIER, R2 (40 WATT)
★ HLD1011A	POWER AMPLIFIER, R1 (60 WATT)
★ HLD1012A	POWER AMPLIFIER, R2 (60 WATT)
★ HLD1031A	POWER AMPLIFIER, R1 (110 WATT)
★ HLD1032A	POWER AMPLIFIER, R2 (110 WATT)
HLD4001B	MAIN BOARD, R1
HLD4002B	MAIN BOARD, R2
HLD4001C	MAIN BOARD, R1
HLN4014A	HARDWARE KIT
HLN4019A	HARDWARE WIRING KIT
HLN4037A	HARDWARE KIT, HI-POWER
HLN4047A	HARDWARE WIRING KIT, HI-POWER
HLN4033A	BOTTOM COVER INNER & GASKET
HLN4044A	BOARD INTERCONNECT

EPS-29766-0

MITREK MOBILE RADIO

POWER AMPLIFIER

136-174 MHz

40, 60, 75 AND 110 WATT

RF POWER

MODEL	DESCRIPTION
HLD1001A	POWER AMPLIFIER, R1 (40 WATT)
HLD1002A	POWER AMPLIFIER, R2 (40 WATT)
HLD1011A	POWER AMPLIFIER, R1 (60 WATT)
HLD1012A	POWER AMPLIFIER, R2 (60 WATT)
HLD1031A	POWER AMPLIFIER, R1 (75/110 WATT)
HLD1032A	POWER AMPLIFIER, R2 (75/110 WATT)

LEGEND:

● = ONE ITEM SUPPLIED

ITEMS	DESCRIPTION
●	HLD4011B POWER AMPLIFIER BOARD, R1 (40 WATT)
●	HLD4012A POWER AMPLIFIER BOARD, R2 (40 WATT)
●	HLD4021B POWER AMPLIFIER BOARD, R1 (60 WATT)
●	HLD4022A POWER AMPLIFIER BOARD, R2 (60 WATT)
●	HLD4041A POWER AMPLIFIER BOARD, R1 (75/110 WATT)
●	HLD4042A POWER AMPLIFIER BOARD, R2 (75/110 WATT)
●	HLD4063A POWER TRANSISTOR KIT (40/60 WATT)
●	HLD4061A POWER TRANSISTOR KIT (40 WATT)
●	HLD4067A POWER TRANSISTOR KIT (75/110 WATT)
●	HLN4021A FEED-THRU PLATE
●	HLN4046A FEED-THRU PLATE
●	HLN4079A HARDWARE LOW-POWER, R1
●	HLN4002A HARDWARE KIT (40 WATT)
●	HLN4080A HARDWARE LOW-POWER, R1
●	HLN4003A HARDWARE KIT, R2 (60 WATT)
●	HLN4005A HARDWARE KIT, R1 (75/110 WATT)
●	HLN4016A ANTENNA SWITCH
●	HLN4041A ANTENNA SWITCH, HI-POWER

EPS-29765-O

OPTIONS

Time-Out Timer HLN4012A
 RF Preamplifier HLD4051A (136-146 MHz)
 RF Preamplifier HLD4052A (146-174 MHz)
 Busy Light HLN4119A and Applicable Control Head

Handset TMN6057A and Handset Hang-Up Box TLN4698A
 Microphone Hang-Up Box with Monitor Switch HLN4025A
 Handset Hang-Up Box with Monitor Switch TLN4507A

Positive ground Cable Kits
 Optional 10 and 22 Foot Cable Kits
 Ignition Sense Lead HKN4007A

Non Weather-Resistant Control Head HLN4004/5/8-11A
 Non Weather-Resistant Microphone HLN4001A

Full Line of SYSTEMS 90 Control Group Options
 SYSTEMS 90 Control Cables

SPECIFICATIONS

GENERAL

Dimensions	40/60 W; 6.35 cm x 25.4 cm x 30.48 cm (2.5" x 10" x 12") 75/110 W; 6.35 cm x 25.4 cm x 36.9 cm (2.5" x 10" x 14.5")
Frequency Range	146-174 MHz
Weight (Less Acc)	40/60 W; 4.76 kg (10.5 pounds) 75/110 W; 6.24 kg (13.75 pounds)
Temperature Range	-30 to +60°C
No. of Frequencies	1 to 4
Polarity	+/-Ground

CURRENT REQUIREMENTS

Standby	.45 A (@13.8 V)
Receiver	2.25 A (@13.8 V)
Transmitter (40 W)	10 A (@13.6 V)
(60 W)	17 A (@13.6 V)
(75 W)	22 A (@13.4 V)
(110 W)	27 A (@13.4 V)

TRANSMITTER

Power Out	40/60 W and 75/110 W
Stability	5 PPM
Distortion	3%
FM Noise	70 dB
Spurs	85 dB
Freq. Separation	3.0 MHz

RECEIVER

Sensitivity	0.5 uV (0.25 uV with optional preamp)
Intermodulation	85 dB (80 dB with optional preamp)
Selectivity	95 dB (30 kHz) 90 dB (25 kHz)
Stability	5 PPM
Modulation Acceptance	± 7 kHz
Spurs	100 dB
Audio Power	8 Watts
Distortion	5%
Freq. Separation	2 MHz

"Mitrek", "Private-Line", "Digital Private-Line", and Systems•90 are trademarks of Motorola, Inc.

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, the applicable schematic diagrams are updated.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 900 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications and Electronics, Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Group products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender"® and "Vibrasponder"® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, code plugs, "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency, and should identify the owner/operator of the communications system in which these items are to be used.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and Electronics Inc.
Communications Group Parts Dept.
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60196
Phone: 312-576-3900

68P81025E81-P

5.2 U.S. ORDERS

WESTERN AREA PARTS

1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS

1313 E. Algonquin Road
Schaumburg, Ill. 60196
Phone: 312-576-7322
TWX: 910-693-0869

MID-ATLANTIC AREA PARTS

7230 Parkway Drive
Hanover, Maryland 20176
Phone: 301-796-8600
TWX: 710-862-1941

EAST CENTRAL AREA PARTS

12995 Snow Road,
Parma, Ohio 44130
Phone: 216-267-2210
TWX: 810-421-8845

EASTERN AREA PARTS

85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-447-4000
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS

P.O. Box 85036
San Diego, California 92138
Phone: 714-578-2222
TWX: 910-335-1634

GULF STATES AREA PARTS

8550 Katy Freeway
Suite 128
Houston, Texas 77024
Phone: 713-932-8955

SOUTHWESTERN AREA PARTS

P.O. Box 34290
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-241-2151
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS

P.O. Box 368
Decatur, Georgia 30031
Phone: 504-981-9800
TWX: 810-766-0876

5.3 CANADIAN ORDERS

CANADIAN MOTOROLA ELECTRONICS COMPANY

National Parts Department
3125 Steeles Avenue,
East Willowdale, Ontario
Phone: 416-499-1441
TWX: 610-492-2713
Telex: 02-29944LD

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.

International Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196 U.S.A.
Phone: 312-576-6492
TWX: 910-693-0869
Telex: 722443 or 722424
Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS AND RESONANT REED ORDERS

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CORRESPONDENCE

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Component Products Sales & Service
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Franklin Park, Illinois 60131



MOTOROLA INC.

Communications
Group

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

EPS-28750-O

WARNING

For vehicles equipped with electronic anti-skid braking systems see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

technical writing services

RADIO AND CONTROL HEAD PREINSTALLATION CONSIDERATIONS

PLACEMENT

radio set onto the mounting plate. The handle should be in the closed position.

radio backward until the top of the mounting plate is flush with the rear of the radio.

handle up until it locks. The top of the radio to make sure the handle has engaged the mounting plate.

REMOVAL

key into the lock and turn clockwise, exposing the rear of the radio.

release button. The top cover will then be disengaged.

When installing the top cover by raising the handle, the negative ground connection will be modified.

REPLACEMENT

for the ground connection at the rear of the radio housing holding the radio in place. The radio will then be engaged.

front of the cover in the closed position. The handle will then be engaged.

REMOVAL

radio set from the workbench.

four Phillips head screws and lift the cover from the radio.

IMPORTANT

POWER OUTPUT

The Motorola **MITREK** fm two-way radio you are installing has been tested for proper transmitter power output before leaving the factory. Each radio is set to the proper output power level while connected to an accurate 50 ohm load impedance. Once the power level has been set, the internal power control/protection circuitry will reduce the power output whenever it senses a load impedance significantly different from 50 ohms. The operation of this circuitry may be different from that of other Motorola products you have installed.

When you check transmitter output power levels during installation, **be sure** you are using a good 50 ohm load impedance and test cables that are as short as possible. Any significant load variation from 50 ohms will cause an **apparent reduction** in output power due to the normal operation of the control/protection circuitry. These variations in power with degraded load impedance will be much more noticeable in the UHF band than in the VHF bands since cables, meters, connectors, etc. have larger effects at UHF. *If power seems to be unusually low* (greater than can be explained by the normal calibration differences you experience) check your test set-up. If power output goes up as you improve the quality of the load impedance (approach 50 ohms), the control/protection circuitry is performing normally.

POWER LEAD COLORS

The color convention for power leads used in MITREK represents a departure from the convention used in MOCOM•70 and earlier radios. In the MITREK system the red lead is always positive and the black lead is always negative. The following statements summarize the use in MITREK installations:

Short lead is chassis ground. It is:

- Black (-) in negative ground systems
- Red (+) in positive ground systems

Fused lead is battery hot. It is:

- Red (+) in negative ground systems
- Black (-) in positive ground systems

PRE-INSTALLATION BENCH TESTS

A. RADIO SET

Check frequency, power output, modulation, and receiver sensitivity before installing the radio.

B. CONTROL HEAD

Verify operation of all controls and indicators on the control head before and after installation.

MOCOM•70 RETROFIT CONSIDERATIONS

A. SYSTEM COMPATIBILITY

RADIO TO BE INSTALLED	VEHICLE INSTALLATION			
	MITREK		MOCOM•70	
	—GND	+ GND	—GND	+ GND
MITREK —GND		•(Note 3)	•(Note 1)	X
MITREK + GND	•	•	•(Notes 1, 4)	X
MOCOM•70 —GND		X	•	•(Note 2)
MOCOM•70 + GND	•(Note 2)	X	•(Note 2)	•

• = Compatible X = Not compatible

NOTES

1. Modify control head as described below.
2. Reverse MOCOM•70 positive ground adapter.
3. Remove JU1 from Interconnect Board of MITREK radio. (JU1 is only required when MITREK radios are used with negative ground MOCOM•70 accessories.)
4. Add JU1 to Interconnect Board of MITREK radio.

B. MODIFICATION TO MOCOM•70 CONTROL HEAD

When installing a MITREK radio into an existing positive ground MOCOM•70 installation, the following modification must be made to the control head:

- Step 1. Remove the green lead from pin 5 of the MOCOM•70 control head connector. Remove the lead to the grounded side of the speaker from the same connector.

- Step 2. Clip off the terminals from these two leads and strip both back 13mm (1/2 inch).

- Step 3. Twist the two leads together and crimp on the closed end splice connector (part number 29-812980) supplied with the installation kit. See Figure.

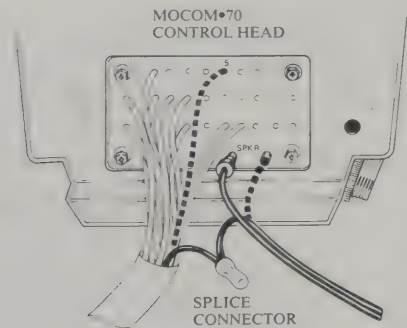
NOTE

If a MITREK control head is used with a MOCOM•70 cable kit in a PL system, then the MOCOM•70 hangup box must also be replaced with a MITREK unit (HLN4024A). Also jumper JU101 must be omitted from the MITREK control head circuit board when the orange ignition switch lead is used.

C. RADIO INSTALLATION

Proceed with radio set mounting instruction on the other side of this sheet.

MOCOM•70 CONTROL HEAD MODIFICATIONS



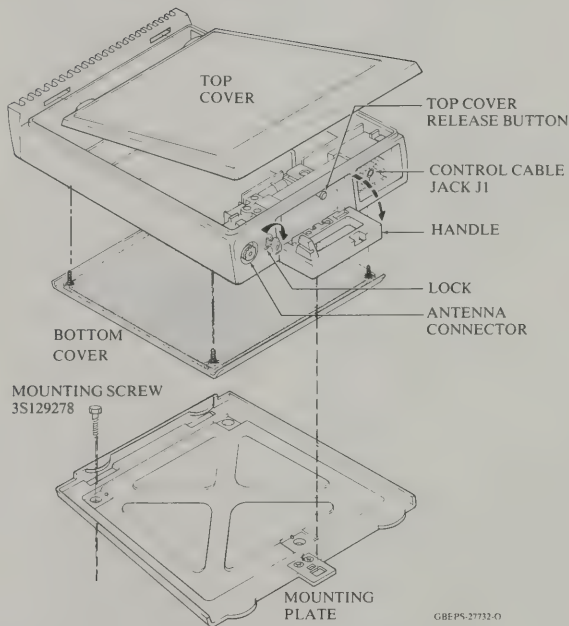
GAEPS 3641-D

DISASSEMBLY

RADIO SET REMOVAL

- Step 1. Insert the key into the lock and turn it clockwise. Pull the handle down.

- Step 2. Remove the radio from the mounting plate by pulling forward with the handle.



RADIO SET REPLACEMENT

- Step 1. Lower the radio set onto the mounting plate using the handle. The handle should be in the fully open position.

- Step 2. Slide the radio backward until the projections at the front and rear of the mounting plate engage the slots on the front and rear of the radio.

- Step 3. Swing the handle up until it locks into position. Lift on the front of the radio to make sure that the latching mechanism on the handle has engaged the latch plate on the front of the mounting plate.

TOP COVER REMOVAL

- Step 1. Insert the key into the lock and turn it clockwise. Pull the handle down, exposing the release button.

- Step 2. Push the release button. The top cover will pop open.

- Step 3. Remove the top cover by raising the front and pulling it forward.

TOP COVER REPLACEMENT

- Step 1. Slip the projections at the rear of the top cover into the slots in the radio housing holding the cover with the front tipped slightly upward.

- Step 2. Lower the front of the cover in place until it snaps. The top latch will then be engaged.

BOTTOM COVER REMOVAL

- Step 1. Remove the radio set from the vehicle and turn it upside down on a workbench.

- Step 2. Unscrew the four Phillips head screws securing the bottom cover and lift the cover from the radio.

INSTALLATION PLANNING

CONTROL HEAD LOCATION

Recommended mounting surfaces include under the dashboard, transmission hump, and center console. The installation must not interfere with operation of the vehicle and its accessories, nor disturb passenger seating or leg space. In addition, the unit must be within convenient reach of the user(s).

ANTENNA LOCATION

The best location for the antenna is the center of the vehicle roof. A good alternate location is the center of the trunk lid. If the trunk lid is used on low band radio installation ONLY, straps must connect the trunk lid to ground points on the vehicle body. Be sure you know that the antenna cable can be acceptably routed to the radio set location before you mount the antenna. Refer to the antenna instruction manual for details.

IGNITION SENSE LEAD (OPTIONAL)

The optional fused (1.5 A) orange ignition sense lead should be connected to the ignition switch terminal which is hot in both the "Accessory" and "On" position. Use of this option will allow the radio to be used in the standby (receive only) mode when the ignition key is removed from the vehicle.

PRIMARY POWER CONNECTIONS

The best power connection point for the hot primary power lead and the green lead is at the hot battery terminal. Be sure that the point chosen is always close to 13.6 volts. Some vehicles switch to a higher-than-normal voltage during starting.

The radio set negative primary power lead should be connected to a good ground point on the vehicle chassis.

GENERAL SAFETY INFORMATION

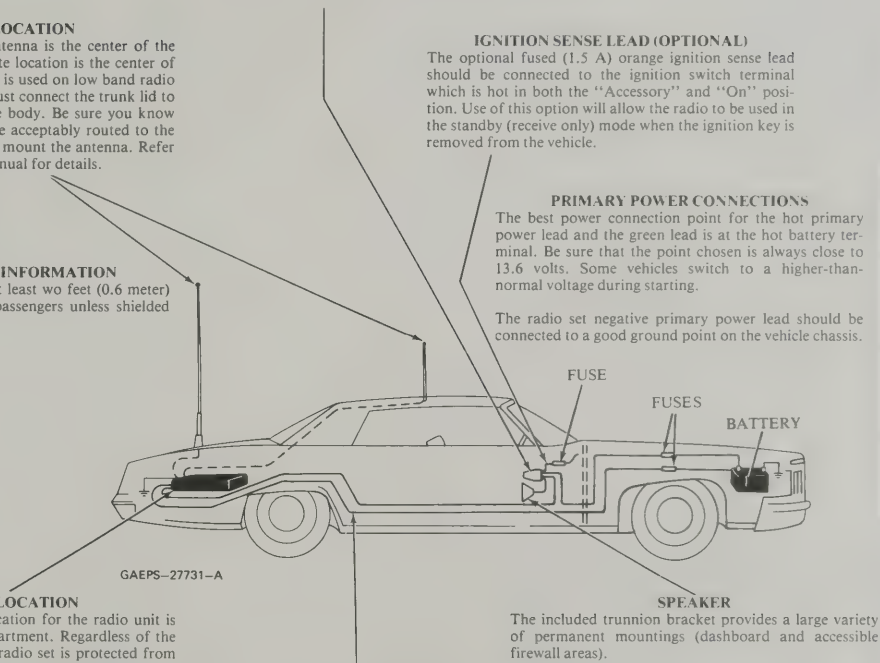
Antennas must be installed at least two feet (0.6 meter) from vehicle operators and passengers unless shielded by a metallic surface.

RADIO SET LOCATION

In most vehicles the best location for the radio unit is the floor of the trunk compartment. Regardless of the location choice, be sure the radio set is protected from dirt and moisture and that there is sufficient space around the radio unit to allow adequate cooling and removal.

CONTROL AND POWER CABLE ROUTING

Many vehicles are equipped with wire troughs in the door sills. If the vehicle has this feature, use it to provide maximum protection for the cable and to simplify the cable installation. In vehicles without wiring troughs the control and power cables must be routed where they are protected from pinching, sharp edges, and crushing. One suggested route is along one side of the drive shaft hump under the carpet. Be sure grommets are used whenever the cable must pass through a hole in a metal panel.



MITREK

RADIO AND CONTROL HEAD PREINSTALLATION CONSIDERATIONS

IMPORTANT

POWER OUTPUT

The Motorola MITREK fm two-way radio you are installing has been tested for proper transmitter power output before leaving the factory. Each radio is set to the proper output power level while connected to an accurate 50 ohm load impedance. Once the power level has been set, the internal power control/protection circuitry will reduce the power output whenever it senses a load impedance significantly different from 50 ohms. The operation of this circuitry may be different from that of other Motorola products you have installed.

When you check transmitter output power levels during installation, be sure you are using a good 50 ohm load impedance and test cables that are as short as possible. Any significant load variation from 50 ohms will cause an apparent reduction in output power due to the normal operation of the control/protection circuitry. These variations in power with degraded load impedance will be much more noticeable in the UHF band than in the VHF bands since cables, meters, connectors, etc. have larger effects at UHF. If power seems to be unusually low (greater than can be explained by the normal calibration differences you experience) check your test set-up. If power output goes up as you improve the quality of the load impedance (approach 50 ohms), the control/protection circuitry is performing normally.

POWER LEAD COLORS

The color convention for power leads used in MITREK represents a departure from the convention used in MOCOM•70 and earlier radios. In the MITREK system the red lead is always positive and the black lead is always negative. The following statements summarize the use in MITREK installations:

Short lead is chassis ground. It is:
Black (-) in negative ground systems
Red (+) in positive ground systems

Fused lead is battery hot. It is:
Red (+) in negative ground systems
Black (-) in positive ground systems

PRE-INSTALLATION BENCH TESTS

A. RADIO SET

Check frequency, power output, modulation, and receiver sensitivity before installing the radio.

B. CONTROL HEAD

Verify operation of all controls and indicators on the control head before and after installation.

68P81109E32-E
(Sheet 1 of 2)
8/1/82-TP

INSTALLATION

Turn on the radio and perform a complete operational check. If ignition noise or alternator whine are noted refer to Motorola publication 68P81109E33—Reducing Noise Interference in Mobile Two-Way Radio Installations.

THEORY OF OPERATION

1. GENERAL

Complete theory of operation for the MITREK radio is contained in the theory notes on the schematic diagram. These diagrams together with the functional block diagram provide all of the theory which an experienced technician will require to service the radio. Detailed theory of operation for those circuits unique to the MITREK radio is given in the following paragraphs.

2. METER 4 CIRCUIT

2.1 GENERAL

2.1.1 The Meter 4 circuitry allows the receiver channel elements to be warped on to the correct frequency using the same zero center meters used on radios with discriminators.

2.1.2 The circuit is basically a low frequency oscillator (approximately 30 Hz) that gates the receiver injection circuitry on and off while an on frequency carrier is being applied. The dc voltage at the output of the detector is sampled both when the channel element is on (indicates actual carrier frequency) and when the channel element is off (indicates desired i-f frequency). The difference between the two voltages indicates how far off frequency and in what direction the channel element is. When the two voltages are identical the channel element is on frequency.

2.2 DETAILED OPERATION

2.2.1 The low frequency oscillator consists of Q2 and Q3 which are wired as a Schmidt trigger and Q1 which also controls the receive switched 9.5 V. During normal receive operation, Q2 and Q3 will have no supply voltage and will be off. Q1 will be turned on and C1 will be charged via R2.

2.2.2 The Meter 4 circuit is activated whenever 9.5 volts is applied to Q2 and Q3. There are three conditions when 9.5 V is applied: (1) during a transmission, (2) when the mobile is netted, and (3) when it is desired to set the receiver frequency.

2.2.3 The setting of the receiver frequency will be covered first. This sequence is initiated by shorting two pins together which applies regulated 9.5 volts to Q2 and Q3. Q2 is held off by the charge on C1, but Q3 turns on. The output of Q3 immediately goes high turning off Q2 which removes RX 9.5 volts. C1 will start discharging through R2 soon reaching a point where Q2 will turn on and Q3 turns off.

2.2.4 Q1 is allowed to turn on again recharging C1. When C1 charges high enough to turn Q2 off the entire sequence repeats itself. The end result is Q2, Q3,

and Q1 oscillate at about 30 Hertz. The phase relationships are such that Q1 always turns off when Q3 turns on.

2.2.5 Whenever Q1 turns off, the receive oscillator is disabled by the removal of the RX 9.5 volts. At the same time Q3 outputs a positive going pulse to Q4 via C2 and Q4 temporarily turns on. C3 starts charging through Q4 and R13 to the dc voltage at the output of the detector buffer. Remember this particular voltage is sampled when the oscillator and thus the the incoming carrier is disabled.

2.2.6 Whenever Q3 turns off, Q1 turns on restoring the RX 9.5 volts enabling the receiver oscillator and the incoming carrier. Q4 is also off at this time and C3 either charges or discharges to the dc voltage now at the detector buffer. This time the voltage is sampled when the oscillator and incoming carrier are enabled. With Q4 turned off any charging or discharging currents through R14 and C3 must flow through the meter movement which is in parallel with Q4. If the carrier developed voltage is higher than the idling voltage C3 will charge more causing the meter to deflect to one side of zero center. If the carrier developed voltage is lower than the idling voltage, C3 will discharge causing the meter to deflect to the other side of zero center. If the carrier developed voltage is identical to the idling voltage C3 will neither charge further nor discharge and the meter will read zero. With a carrier of known good frequency applied, the meter 4 circuit is activated and the channel element is warped until the meter reads zero center. At this point C3 is neither charging nor discharging and the receiver is right on frequency.

2.2.7 When a transmission occurs, the push-to-talk circuit activates the TX 9.5 V which is applied to Q2 and Q3. The circuit does not oscillate through because the secondary push-to-talk line clamps the input of Q3 low and Q3 remains turned on for the duration of the transmission. Q3 in turn keeps Q1 turned off disabling the RX 9.5 volts. Thus part of the Meter 4 circuit is used to disable the receiver when transmitting.

3. POWER CONTROL AND PROTECTION CIRCUIT

3.1 GENERAL

3.1.1 The power control and protection circuit protects the rf power amplifier from overcurrent and overtemperature by reducing the drive during these conditions. In addition, it limits the maximum amount of drive that may be developed during undercurrent conditions such as when a driver or final device is faulty or during certain high VSWR conditions. Last, the protection circuit has a 15 mS turn-on delay to delay the generation of rf during antenna switching.

MITREK
RADIO AND CONTROL HEAD
INSTALLATION PROCEDURE

CABLE ROUTING

WARNING

For vehicles equipped with electronic anti-skid braking systems see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

Work from the trunk space forward. In some cars there is room above the fiberboard trunk partition to admit the cables. If this is not the case, make an opening through the partition.

Tape the pin-tip connectors into a small bundle. Pass it and the long power lead forward into the passenger compartment.

Remove the back seat. Pull the cables into the back seat area, under the seats and floor mats out the top of the floor mat under the dash. Where no specific channel is provided, route the cable under the floor mat along the side of the drive-shaft hump.

Pull the control cable pin-tip connectors to the approximate location of the control head. Locate or make a hole through the firewall to route the power cable into the engine compartment. The hole must be 28.6 mm (1-1/8") in diameter to fit the supplied rubber grommet. Install the grommet. Pull the red power cable and fuse holder through the grommeted hole.

On high power models install the fuse holder clip at a convenient location near the battery.

The cable kit contains an additional separate green wire equipped with an in-line fuse. Pass the pin tip end of the green wire from the engine compartment side of the firewall, through the grommeted hole, into the passenger compartment.

An optional orange wire with fuse may be supplied. This wire will connect from the control head to the ignition switch.

Do not dress the wires at this time but proceed with the radio set mounting procedure.

68P81109E32-E
(Sheet 2 of 2)
8/1/82-TP

RADIO SET MOUNTING

- Step 1. Determine a location for the radio reasonably protected from dirt and moisture.
- Step 2. Place the radio in the desired location and check for proper clearances as shown in the diagram at the right.
- Step 3. Determine the exact mounting location and set the radio mounting plate in position. Using the mounting plate as a template mark the location of the three mounting screw holes.
- Step 4. Check underneath the vehicle to make sure that the drill and mounting screws will not encounter the gas tank, drive shaft, or other obstacles.
- Step 5. Drill three 5 mm (0.199 inch) holes at the marked locations.
- Step 6. Install the mounting plate with the three mounting screws provided. These screws are self-locking and require no lock washers or flat washers. An assortment of additional screws and spacers are provided for installing the mounting plate over extremely irregular surfaces.
- Step 7. Install the radio per the instructions for radio set replacement on the other side of this sheet.

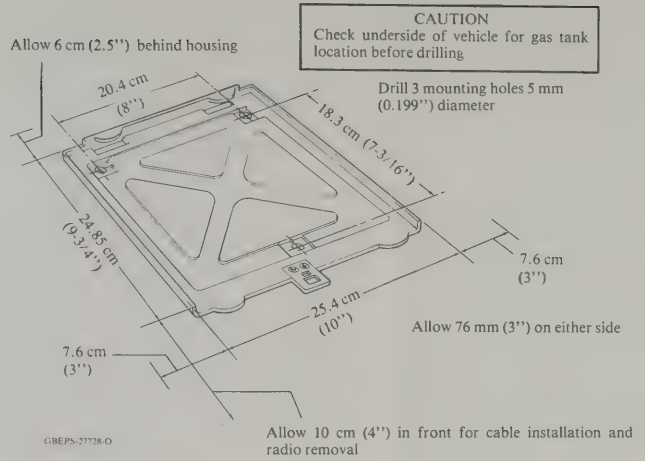
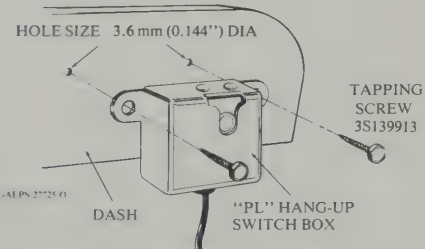


Table 1.
Contents of Installation Kit

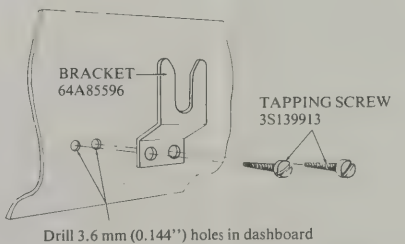
Qty.	Part No.	Description	Qty.	Part No.	Description
4	3-139965	Screw, tapping, 1/4-14 x 1/2	1	3-140075	screw, tapping, 1/4-14 x 7/8"
1	4-7688	Washer, locking, 1/4 internal	1	3-140076	screw, tapping, 1/4-14 x 1-1/8"
1	29-812980	Terminal, crimp, closed end	1	3-140077	screw, tapping, 1/4-14 x 1-1/2"
1	37-103890	Grommet, rubber	3	43-82292M01	BUSHING, spacer
6	42-10217A14	Strap, tie, 0.140 x 5.50, nylon			

C. MICROPHONE HANGUP BOX (PL OR DPL MODELS)



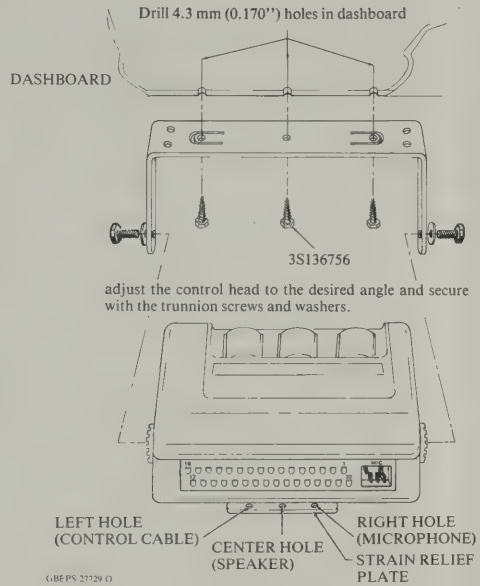
Install hangup box lead pins to correspondingly numbered slots at the rear of the control head; lead labeled 24/30 should be installed into slot 30 for busy light radios with busy light control heads, into slot 24 for all other systems.

D. MICROPHONE HANGUP CLIP (CARRIER SQUELCH MODELS)



CONTROL HEAD, SPEAKER, AND ACCESSORIES

A. CONTROL HEAD

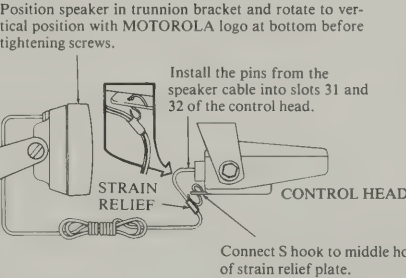
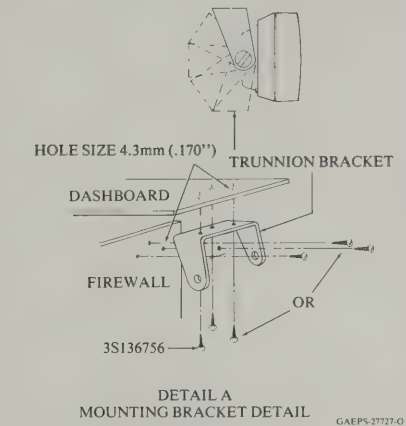


Install the pins from the control cable into correspondingly numbered slots on the radio cable connector at the rear of the control head; also the pin from the green (and orange if supplied) power lead. Connect the S hook on the control cable to the left hole in the strain relief plate.

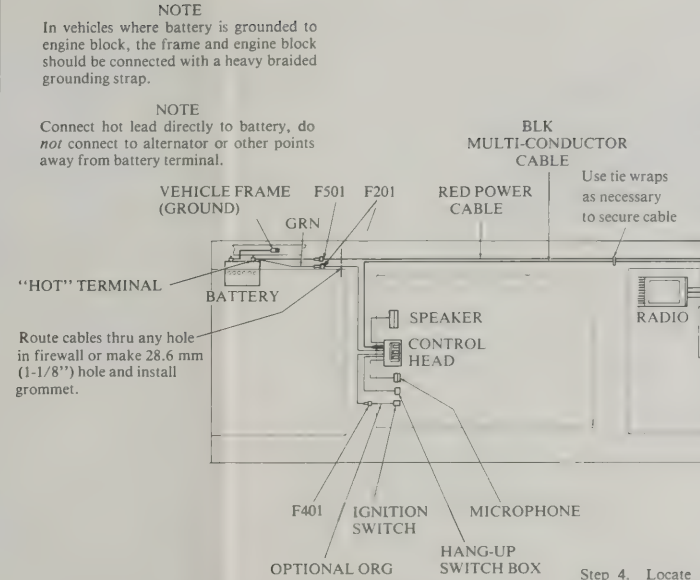
E. MICROPHONE

- Step 1. Plug the microphone connector into the receptacle on the control head. Connect the S hook to the right hole of the strain relief plate.
- Step 2. Hang the microphone in the hangup box or microphone clip.

B. SPEAKER



POWER CONNECTIONS



- Step 1. Connect the fused power cable (red for - Gnd, black for + Gnd) from the trunk to the ungrounded battery terminal. NOTE: For positive ground installations remove jumper JU1 on interconnect board in the MITREK radios.
- Step 2. Connect the fused green wire from the control head also to the ungrounded battery terminal.
- Step 3. If the ignition switch option is used, connect the orange fused lead from the control head to the ignition switch terminal which is hot when the switch is either in the ON or ACCESSORY position. Remove jumper JU101 in the control head.
- Step 4. Locate a good site near the radio for the ground connection. This connection should be made directly to the vehicle frame. Drill a 5mm (0.199 inch) hole after checking clearance behind the hole location to make sure the drill or screw will not encounter the gas tank or other obstacles. Carefully scrape or wire brush the surface around the hole to assure a good electrical connection.
- Step 5. Attach the unfused power lead from the radio (black for -Gnd, red for +Gnd) to the frame using the fourth mounting screw and the lockwasher provided. The lockwasher should be inserted between the wire lug and the grounding surface; the mounting screw does not need an additional lockwasher as it is self-locking.
- Step 6. Dress all cables, securing them with tie-straps as required.

ANTENNA INSTALLATION

A diagram and complete installation instructions are supplied with each antenna ordered.

POST-INSTALLATION CHECKOUT

Turn on the radio and perform a complete operational check. If ignition noise or alternator whine are noted refer to Motorola publication 68P81109E33—Reducing Noise Interference in Mobile Two-Way Radio Installations.

THEORY OF OPERATION

1. GENERAL

Complete theory of operation for the MITREK radio is contained in the theory notes on the schematic diagram. These diagrams together with the functional block diagram provide all of the theory which an experienced technician will require to service the radio. Detailed theory of operation for those circuits unique to the MITREK radio is given in the following paragraphs.

2. METER 4 CIRCUIT

2.1 GENERAL

2.1.1 The Meter 4 circuitry allows the receiver channel elements to be warped on to the correct frequency using the same zero center meters used on radios with discriminators.

2.1.2 The circuit is basically a low frequency oscillator (approximately 30 Hz) that gates the receiver injection circuitry on and off while an on frequency carrier is being applied. The dc voltage at the output of the detector is sampled both when the channel element is on (indicates actual carrier frequency) and when the channel element is off (indicates desired i-f frequency). The difference between the two voltages indicates how far off frequency and in what direction the channel element is. When the two voltages are identical the channel element is on frequency.

2.2 DETAILED OPERATION

2.2.1 The low frequency oscillator consists of Q2 and Q3 which are wired as a Schmidt trigger and Q1 which also controls the receive switched 9.5 V. During normal receive operation, Q2 and Q3 will have no supply voltage and will be off. Q1 will be turned on and C1 will be charged via R2.

2.2.2 The Meter 4 circuit is activated whenever 9.5 volts is applied to Q2 and Q3. There are three conditions when 9.5 V is applied: (1) during a transmission, (2) when the mobile is netted, and (3) when it is desired to set the receiver frequency.

2.2.3 The setting of the receiver frequency will be covered first. This sequence is initiated by shorting two pins together which applies regulated 9.5 volts to Q2 and Q3. Q2 is held off by the charge on C1, but Q3 turns on. The output of Q3 immediately goes high turning off Q2 which removes RX 9.5 volts. C1 will start discharging through R2 soon reaching a point where Q2 will turn on and Q3 turns off.

2.2.4 Q1 is allowed to turn on again recharging C1. When C1 charges high enough to turn Q2 off the entire sequence repeats itself. The end result is Q2, Q3,

and Q1 oscillate at about 30 Hertz. The phase relationships are such that Q1 always turns off when Q3 turns on.

2.2.5 Whenever Q1 turns off, the receive oscillator is disabled by the removal of the RX 9.5 volts. At the same time Q3 outputs a positive going pulse to Q4 via C2 and Q4 temporarily turns on. C3 starts charging through Q4 and R13 to the dc voltage at the output of the detector buffer. Remember this particular voltage is sampled when the oscillator and thus the incoming carrier is disabled.

2.2.6 Whenever Q3 turns off, Q1 turns on restoring the RX 9.5 volts enabling the receiver oscillator and the incoming carrier. Q4 is also off at this time and C3 either charges or discharges to the dc voltage now at the detector buffer. This time the voltage is sampled when the oscillator and incoming carrier are enabled. With Q4 turned off any charging or discharging currents through R14 and C3 must flow through the meter movement which is in parallel with Q4. If the carrier developed voltage is higher than the idling voltage C3 will charge more causing the meter to deflect to one side of zero center. If the carrier developed voltage is lower than the idling voltage, C3 will discharge causing the meter to deflect to the other side of zero center. If the carrier developed voltage is identical to the idling voltage C3 will neither charge further nor discharge and the meter will read zero. With a carrier of known good frequency applied, the meter 4 circuit is activated and the channel element is warped until the meter reads zero center. At this point C3 is neither charging nor discharging and the receiver is right on frequency.

2.2.7 When a transmission occurs, the push-to-talk circuit activates the TX 9.5 V which is applied to Q2 and Q3. The circuit does not oscillate through because the secondary push-to-talk line clamps the input of Q3 low and Q3 remains turned on for the duration of the transmission. Q3 in turn keeps Q1 turned off disabling the RX 9.5 volts. Thus part of the Meter 4 circuit is used to disable the receiver when transmitting.

3. POWER CONTROL AND PROTECTION CIRCUIT

3.1 GENERAL

3.1.1 The power control and protection circuit protects the rf power amplifier from overcurrent and overtemperature by reducing the drive during these conditions. In addition, it limits the maximum amount of drive that may be developed during undercurrent conditions such as when a driver or final device is faulty or during certain high VSWR conditions. Last, the protection circuit has a 15 mS turn-on delay to delay the generation of rf during antenna switching.

3.1.2 The circuitry may be separated into two portions. A regulation loop has control during normal operation and senses overcurrent and/or overtemperature. A drive limit loop limits the maximum drive when the power amplifier current drops below the operating point of the regulation loop.

3.1.3 A third loop is provided on the 75 and 110-watt models. This loop protects the driver as well as the final amplifier by sensing and limiting the driver current.

3.2 DRIVE LIMIT LOOP

3.2.1 The limit loop, consisting of U901, Q903 and Q904, acts as a limiter for the variable control voltage which is applied to the various exciter and power amplifier stages. Whenever the diode CR902 is reverse biased, the limit loop will go to a condition where the potentials at the inverting and non-inverting inputs to U901 are equal. The control voltage may be varied by R911, the Drive Limit Control, which is part of a voltage divider in the feed back path from Q904 to U901. R911 is adjusted during initial alignment by watching a wattmeter and setting the power output about 10% above rated power. The control voltage output in this mode (when CR902 is reverse biased) represents the maximum amount of drive possible under any operating conditions.

3.2.2 Any time CR902 becomes forward biased and a higher potential is applied to the inverting input to U901, the limit loop is upset and the control voltage drops to some value lower than maximum drive. During normal operation CR902 is forward biased by the regulation loop.

3.3 FINAL AMPLIFIER REGULATION LOOP

3.3.1 The final amplifier regulation loop serves double duty as both a power regulator for the final amplifier and an overcurrent or overtemperature protection circuit. Q902 senses these input sources via CR901. If, for any reason, any of these inputs go lower than normal the output of Q902 will go higher, the inverting input to U901 will go higher, and the control voltage output will go lower reducing the drive to the driver and final amplifier stages. The turn-on of CR902 is controlled by R909, the Power Set control, which is adjusted during alignment for rated power.

3.3.2 One input to CR901 monitors the final current. The current drawn by the final amplifier must flow through R801, a low series resistance shunt, causing a slight voltage drop which will be felt at Q902 through R802. The second input to CR901 monitors the PA deck temperature. If the temperature in the PA compartment exceeds approximately 95°C, RT801 decreases its resistance enough to allow the voltage, at R804, to forward bias CR801. The input to Q902 will again start to drop. Any low applied to Q902 will cause

the output of Q902 to go higher. This will forward bias CR902, upsetting the limit loop, causing the control voltage output to be reduced.

3.4 DRIVER REGULATION LOOP (Included on 75 and 110-watt models only).

3.4.1 The driver regulation loop provides protection for both the driver and the final amplifiers by limiting the driver current and power output. Transistor Q805 senses the driver current via R822 and CR803. The output from this stage is determined by the setting of potentiometer R826. This output is coupled through CR804 and is used to drive control amplifier U901 located on the main board. Potentiometer R826 is adjusted for a power output which is above the power level set by the final amplifier regulation loop.

3.4.2 Under normal conditions, the output of Q805 is too low to forward bias CR804 and the regulator loop controls the drive. When excess driver current is drawn, the input to Q805 decreases and the output increases. The inverted input to U901 increases and the control voltage output decreases, thus reducing the drive to the power amplifier.

3.5 OPERATION

3.5.1 The normal operating point is set by adjusting R909, the Power Set control, for the rated power output. At this point CR902 will be forward biased. The current drawn by the PA final amplifier flows through R801 and the voltage drop across R801 is applied to Q902. If the final current tries to increase, the input to Q902 will go lower, its output will go higher, the inverting input to U901 will go higher and the control voltage will go lower, reducing the drive level causing the final current to return to normal. If the PA current tries to decrease the opposite will take place. The input to Q902 will go higher, its output will go lower, the inverting input to U901 will go lower and the control voltage will go higher causing the PA current to return to normal. If for some reason the PA current cannot be brought up to normal, such as a PA failure, the output of Q902 will not change when the control voltage increases and CR902 will become reverse biased. When this happens the limit loop reverts to its limiting mode.

3.6 INITIALIZATION

3.6.1 When the radio is keyed, SEC PTT goes low allowing Q902 to saturate (C916 charging through the base-emitter junction of Q902 and R926 holds Q902 saturated). This forward biases CR902 which forces U901-2 high and pulls U901-6 low. Q903 and Q904 are cutoff and there is no drive applied to the control stages.

3.6.2 After 15 milliseconds, C916 has charged sufficiently through Q901 to reduce Q902 conduction reverse biasing CR902. This allows U901-2 to be pulled low and U901-6 goes high turning on Q903-Q904.

As the power amplifier turns on, the voltage drop across R801 increases allowing Q902 to conduct harder. CR902 is again forward biased allowing the control voltage to be reduced to its adjusted value.

4. BRIDGE AUDIO CIRCUIT

4.1 The unique bridge audio circuit provides a highly efficient audio output. The circuit uses two differential power amplifiers which provide a balanced push-pull output to the speaker.

4.2 Audio is applied from the audio amplifier to the non-inverting input of U401. The output of U401 is applied to both one side of the speaker and to U402. R422 and R423 form a voltage divider that attenuates the high level output of U401 before it is applied to the inverting input of R402. The output of U402 is equal in amplitude to the output of U401 but 180° out of phase.

MAINTENANCE/TROUBLESHOOTING

1. GENERAL

1.1 The MITREK radio is designed for ease of access and servicing. The entire radio may be aligned from the top after removing the top cover. The radio is easily removable from the vehicle, and the entire solder side of the main circuit board can be accessed for troubleshooting by merely removing the four screws holding on the weatherproof bottom cover.

1.2 Full maintenance information for the radio is provided on the schematic diagram and the functional block diagram. The schematic diagram is highlighted with theory notes for each significant stage and has maintenance notes and AC signal levels distributed at key points in the circuit. These levels are also shown on the functional block diagram. The measurement points for the AC levels are keyed on the circuit board detail to allow rapid location and identification by the technician. DC voltages are provided on the schematic for most transistor leads.

2. RADIO SET DISASSEMBLY

2.1 REMOVAL OF RADIO SET FROM THE VEHICLE

An illustrated step-by-step procedure for removal and replacement of the radio is given on the Pre-installation Considerations pull-out page in this manual.

2.2 TOP AND BOTTOM COVER

An illustrated step-by-step procedure for removal and replacement of the top and bottom covers is given on the Pre-installation Considerations pull-out page in this manual.

2.3 OPTIONAL "PRIVATE-LINE"/"DIGITAL PRIVATE-LINE" BOARD

To remove the board, remove four mounting screws and unplug the board from J3 on the interconnect board. To replace the board reverse the removal procedure.

2.4 INTERCONNECT BOARD

To remove the interconnect board, remove the "PRIVATE-LINE"/"DIGITAL PRIVATE-LINE" board, and the time-out timer board (if used). Remove one Phillips head screw from the mounting bracket, and two Phillips head screws, from the radio connector on the front of the chassis. Slightly lift the board, tilt it toward the rear, and lift it out of the chassis. To replace the board, reverse the removal procedure, being careful to seat J10 into P10 on the main board.

2.5 ANTENNA SWITCHING RELAY

To remove the antenna switching relay, unsolder two leads to the relay coil, and two coax cables from the receiver input, and harmonic filter output. Remove a lock nut from the front of the chassis with a spanner wrench (RSX4028A Spanner Nut Removal Tool available from Motorola National Parts), and remove the relay. To replace the relay, reverse the removal procedure.

2.6 MAIN BOARD REMOVAL

To remove the main board, remove nine hex head mounting screws, and four transistor mounting screws, from the chassis walls. Unsolder and remove two coax cables, the wiring to five feedthru capacitors, and two leads to the antenna relay. Remove the board from the bottom of the chassis. To replace the main board, reverse the removal procedure, taking care to replace the transistor insulators, and shoulder washers, to prevent the transistors from shorting to the chassis wall.

2.7 OPTIONAL RF PREAMPLIFIER REMOVAL

To remove the rf preamplifier, insert the flat metal end of the alignment tool (or small screwdriver) into the slot provided on the board (below L152) and pry straight up using the chassis for leverage. To replace, carefully line up the contacts and press the board in place.

3. POWER AMPLIFIER

3.1 TRANSISTOR REPLACEMENT

3.1.1 To remove the power transistors, remove two transistor mounting screws, or one stud nut (accessible from the chassis bottom). Unsolder and remove the clamped mica capacitors, unsolder, and remove the transistors. (Special soldering iron tips ST1160, and ST1161 are available from the Motorola Parts Department, to aid in the capacitor and transistor removal.)

3.1.2 When replacing rf power transistors, several precautions *must* be observed. First removal all thermal compound and residue from *both the chassis and the transistor* using a soft cloth or paper towel. Apply a thin film of Wakefield thermal compound to the bottom of the transistor mounting flange. Replace the transistor in the center of the printed circuit board cutout tightening the mounting hardware to 6-7 inch pounds *maximum*. Solder leads using a low power (40-60 W) iron using enough solder to completely cover the lead and solder pad. *Make sure* that the solder is flowing freely both *over and under the lead before removing the heat*. *If a lead tends to spring away from the printed circuit board, hold down the far end of the lead against the board (using the tip of pliers) until the solder hardens*. Be sure to replace C825 and/or C826 in the *exact* original position with respect to the transistor body after replacing Q803-Q804.

3.1.3 When removing components from the power amplifier printed circuit board it is *essential* that the solder be *completely molten* around the lead(s) to be removed *before* attempting to remove any component(s). Failure to exercise this precaution *could result* in removal of through-plating in component holds and/or top side metal on the printed circuit board which may necessitate removal of the printed circuit board for repair. To ensure proper performance of the rf power amplifier, it is *essential* (when replacing board-mounted parts) that the parts be mounted vertically and with the bottom of the component(s) as close as possible to the printed circuit board.

3.2 POWER AMPLIFIER BOARD REMOVAL

3.2.1 Under normal maintenance conditions there should be no need to remove the PA board. If, however, it should become necessary the following procedure should be used. Unsolder and remove the input and output coax cables, unsolder feedthru capacitors, remove hex head screws, transistor mounting screws, and stud nut(s) (accessible from the bottom). Lift the board out of the chassis.

3.2.2 To replace the PA board, reverse the removal procedure. PA power transistors should be installed after the PA board installation has been completed. Refer to paragraph 3.1. Note that for the 75 and 110-watt models, the output coax cable is accessed by removing the cover from the harmonic filter.

4. HIGH POWER PA FIELD REPAIR FAILURE ANALYSIS

The following checks assume that 13.4 V dc is applied to the radio set through a standard cable kit and that all power control potentiometers (R826, R909, and R911) are positioned fully clockwise with the radio set keyed on a defective channel (unless otherwise stated).

4.1 NO POWER OUTPUT OR POWER OUTPUT LESS THAN 20 WATTS

4.1.1 Voltage and Overall Current Checks

With the radio unkeyed and the receiver audio at a minimum, check for +13.3 V dc on the Q801-804 collectors and for the power supply current drain.

Step 1. If one or more stages has zero voltage, check associated dc-feed circuits for an open circuit.

Step 2. If more than 5 amperes is being drawn from the power supply, check for A+ or A- shorts on the printed circuit board. Check *closely* under coil L804, L808, L811, and L813 (lifting them if necessary) for shorts due to punctured insulation on coil and printed circuit board.

4.1.2 Individual Stage Current Checks

Check the collector currents drawn by all stages to determine if the normal value shown in Table 1 is drawn.

Step 1. If a stage is found with less than minimum I_c (see Table 1), check for shorts or defective components in that stage, then in the preceding and following stages.

Step 2. Where more than one stage indicates low current, check the earliest defective stage (toward the PA input) first.

Step 3. If all stages give a low current indication, check the exciter output. The exciter is defective or mistuned if the output is less than 1.5 W. If the exciter output is low at this step, retune per standard tune up procedure given in the instruction manual. If the power amplifier output is still low, remeasure the exciter output.

4.1.3 Continuity Checks

If all stages show near normal I_c , check the harmonic filter, output cable, and antenna switch for shorts, opens, or defective parts. Continuity checks (made with the radio keyed, but all transmit channel elements removed) can be used to isolate the fault.

4.1.3.1 No connection from the center pin of the UHF connector to the junction of L814 and C847 indicates an open antenna switch, cable or harmonic filter, or defective switching circuit.

Step 1. Check for at least 5 V dc across the antenna switch coil. If this voltage is low or absent, check for defects in the regulator/switching circuitry on the main board.

Step 2. Check back from L814 to the antenna cable center conductor in the harmonic filter to isolate the open section. If no connection is found at the antenna cable conductor, replace the antenna switch assembly.

4.1.3.2 A short from the center pin of the UHF connector to the chassis indicates a shorted antenna switch cable or harmonic filter, or reversed antenna switch coil leads.

Step 1. Check for the proper polarity of voltage on the antenna switch coil as indicated by the + and - markings on the coil bobbin.

Step 2. Visually check for shorts in the harmonic filter. If no shorts are visible, remove the output cable from the harmonic filter. If a short still exists at the UHF connector, replace the antenna switch assembly.

Step 3. Remove L816 and check across C850 and C851 to isolate the short to one half of the filter. Continue removing remaining coils L814-L818 and checking for shorts on either side until the short is isolated. If the short disappears upon the removal of a coil, replace the coil and reassembly the power amplifier.

Step 1. If all voltages are low, recheck the power supply. If the power supply is satisfactory, check the feed-through connections for poor solder connections.

Step 2. If only one or two stages have low voltages, trace back through the dc-feeds of these stages checking for bad connections or defective components. The maximum normal voltage drops are 0.3 V dc for R801, 0.5 V dc for R822, and less than 0.1 V dc for all other components in the dc-feed circuits.

4.2.2 Check the stage currents as outlined in paragraph 4.1.2.

4.2.3 If trouble in the finals (Q803, Q804) is indicated, or other approaches have failed, check the balance in the final amplifier by soldering a 2.7 V lamp (type 338, Motorola Part No. 65-82671G01) across R819 using #14 wire or a 0.1 inch wide copper strap or braid. If the lamp lights up to greater than half its normal brilliance, or flashes and burns out, there is a defect in one side of the parallel final amplifier circuitry. If such imbalance is indicated, the defective section can usually be isolated by shorting the base to emitter of one transistor (at the transistor body, opposite C825 or C826) with a screwdriver blade. The section that shows the least drop in power output (when shorted) is the one to be checked for defective components. If no obviously defective passive components, misconnections, or shorts can be located, make the following tests prior to considering the replacement of Q803 or Q804.

Table 1. Minimum Normal Current Readings (All Power Control Potentiometers Set Fully Clockwise)

		136-146 MHz	146-155 MHz	155-165 MHz	165-174 MHz
Q801	Ic-direct	.75A	1.7A	1.2A	0.75A
Q802	Ic-direct	2.0A	2.4A	2.4A	2.5A
Q802	Ic-drop across R822	200 mV	240 mV	250 mV	250 mV
Q803, 4	Ic-direct	14A	16A	16A	16A
Q803, 4	Ic-drop across R801	140 mV	160 mV	160 mV	160 mV
Q803, 4	Ic-MTR 7	9.5 uA	11 uA	11 uA	11 uA

NOTE: "Direct" current measurements taken by inserting ammeter into transistor dc feed circuit at the common A + connection.

4.2 POWER OUTPUT LESS THAN 130 W AT MAXIMUM POWER SETTINGS

4.2.1 Check A+ and A- voltages at the Q801-Q804 collectors with the power amplifier operating. Use **only** a passive voltmeter or a VOM with 1.2 uH series chokes at the probe tips. With the power supply accurately set for 13.4 V dc, voltages on the transistor collectors should exceed the following values (all voltages measured with respect to the A- plating on the power amplifier board):

Q801 — +12.0 V dc
Q802 — +11.6 V dc
Q803, 4 — +11.8 V dc

NOTE

Remove all power from the radio set for the following tests.

Step 1. Check in-circuit base-emitter resistance on the suspect transistor(s). If greater than 1 ohm, coil L809 or L810 is bad.

NOTE

Place the negative potential lead from the ohmmeter on the transistor base for this test.

Step 2. If the resistance check shows that L809 and L810 are not defective, remove capacitor (C825 or C826) and check it for shorts, both internal (with an ohmmeter), and external (visual check for solder shorts

on the capacitor or printed board). If the capacitor or its connection is suspect, replace it and recheck the power output and balance before proceeding.

Step 3. If the capacitor is not defective, replace transistor (Q803 or Q804) and reassemble the power amplifier.

NOTE

In any case where gross imbalance is found and suspected faulty components are replaced, *always* recheck balance after replacing components. Continue the investigation if imbalance has not been fully corrected.

- 4.2.4 With all power removed from the radio set, check for open base returns on Q801 and Q802

by measuring in-circuit base-emitter resistance. The resistance should be less than 1 ohm on Q801 and less than 2.5 ohms on Q802.

NOTE

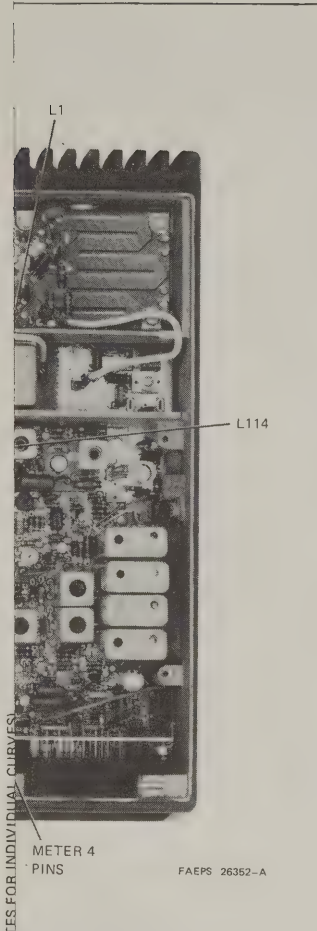
Place negative potential lead of ohmmeter on transistor base(s) for this test.

5. IGNITION NOISE AND ANTI-SKID BRAKING

If the MITREK radio is to be used in a vehicle employing an anti-skid braking system, refer to Motorola publication 68P81109E34 "Anti-Skid Braking Precautions". If ignition noise or alternator whine are a problem, refer to Motorola publication 68P81109E33 "Reducing Noise Interference in Mobile Two-Way Radio Installations". These two publications are available at no charge from Motorola and may be ordered using the self-mailer in the back of this manual.

HIGH BAND MITREK

RECEIVER ALIGNMENT AND TEST EQUIPMENT LIST



Alignment Locations

on the capacitor or printed board). If the capacitor or its connection is suspect, replace it and recheck the power output and balance before proceeding.

Step 3. If the capacitor is not defective, replace transistor (Q803 or Q804) and reassemble the power amplifier.

NOTE

In any case where gross imbalance is found and suspected faulty components are replaced, *always* recheck balance after replacing components. Continue the investigation if imbalance has not been fully corrected.

4.2.4 With all power removed from the radio set, check for open base returns on Q801 and Q802

by measuring in-circuit base-emitter resistance. The resistance should be less than 1 ohm on Q801 and less than 2.5 ohms on Q802.

NOTE

Place negative potential lead of ohmmeter on transistor base(s) for this test.

5. IGNITION NOISE AND ANTI-SKID BRAKING

If the MITREK radio is to be used in a vehicle employing an anti-skid braking system, refer to Motorola publication 68P81109E34 "Anti-Skid Braking Precautions". If ignition noise or alternator whine are a problem, refer to Motorola publication 68P81109E33 "Reducing Noise Interference in Mobile Two-Way Radio Installations". These two publications are available at no charge from Motorola and may be ordered using the self-mailer in the back of this manual.

REQUIRED TEST EQUIPMENT FOR MITREK RADIO SERVICING			
GENERAL TYPE	APPLICATION	RECOMMENDED MODEL	MINIMUM SPECIFICATIONS
AC-DC VOM	DC voltage measurements, general	Motorola T1009A	Measurement range: 0-15 V dc Sensitivity: 20,000 ohms/volt
DC Multimeter	DC voltage readings requiring a high input resistance meter.	Motorola S1063B	Measurement range: 0-15 V dc Input resistance: 11 megohms
AC Voltmeter	Audio voltage measurements	Motorola S1053C	Measurement range: 0-10 V ac Input resistance: 10 megohms
RF Voltmeter	RF voltage measurements	Motorola S1339A	Measurement range: 100 uV-3 V from 1 MHz-512 MHz Inputs: 50 ohm and high impedance
Oscilloscope	Waveform observation	Motorola R1004A	Vertical sensitivity: 5 mV - 10 V/division Horizontal time base: 0.2 usec. 0.5 sec/division
RF Wattmeter	Transmitter output power measurement	Motorola S1350A with appropriate element and T1013A RF Dummy Load	Measurement range: 0-100 Watts
Frequency Meter	Transmitter frequency measurement	Model R1200A Service Monitor with high stability oscillator (X suffix) option. Frequency calibration recommended every 6 months or less.	Measurement range: 134-174 MHz Frequency resolution: 10 Hz
Deviation Meter	Transmitter modulation deviation measurement	Motorola R1200A Service Monitor	Measurement range: 0-10 kHz deviation Frequency range: 134-174 MHz
RF Signal Generator	Receiver Alignment and troubleshooting	Motorola R1200A Service Monitor with attenuator	Frequency range: 134-174 MHz Output Level: 0.1 uV-100,000 uV Must be capable of at least ± 3 kHz deviation when modulated by 1 kHz tone.
Audio Signal Generator	Audio Circuit troubleshooting	Motorola S1067B	Frequency range: 20 Hz-20 kHz Output Level: 50 mV-1 V
PL Tone Generator*	Tone-Coded "Private-Line" Decoder Troubleshooting	Motorola S1333B	Frequency range: 10 Hz-9999 Hz Output Level: 0-3 V rms
DPL Test Set**	"Digital Private-Line" Encoder-Decoder Troubleshooting	Motorola SLN6413A	
Radio Test Set w/appropriate metering cable SKN6012B	Meter readings at circuit metering points for alignment and troubleshooting	Motorola S1056B Portable Test Set, TEK5B-E Metering Panel with RPX4053A Conversion Kit, or TEK5F Metering Panel.	
Tuning Tool Kit	Receiver and transmitter alignment	Motorola HLN4023A	
DC Power Supply	DC power for shop service	Motorola R1011AA	1-20 V DC 0-40 A

*Required for tone-coded "Private-Line" models only
**Required for "Digital Private-Line" models only

NOTE

Versions B-E of TEK5 Metering Panel must be modified with RPX4053A Conversion Kit before use with MITREK radio.

FREQUENCY CALCULATIONS

FREQUENCY (MHz)	CALCULATION
136-174	$f_o = \frac{f_c - 10.7}{3}$

Where f_o = crystal frequency, f_c = carrier frequency

POSITIVE GROUND SYSTEMS — CAUTION:

In positive ground systems the case of the TEK5 Meter Panel and portions of the S1056B Portable Test Set are hot with respect to the vehicle chassis due to the nature of the positive ground installation. Take necessary precautions that the test equipment does not contact the vehicle chassis.

VHF MITREK RECEIVER ALIGNMENT PROCEDURE

1. The tuning procedure should be performed using the Motorola portable test set or the TEK5 set to position A. If using the TEK5-F or modified TEK5-B through TEK5-E meter panels, put the M1, 2 polarity switch in the reverse position and ignore the indicated polarity notes.

2. IMPORTANT: When using the Motorola portable test set for M4 place the FUNCTION SELECTOR SWITCH to the XMTR position. Switch polarity as necessary for proper M4 operation.

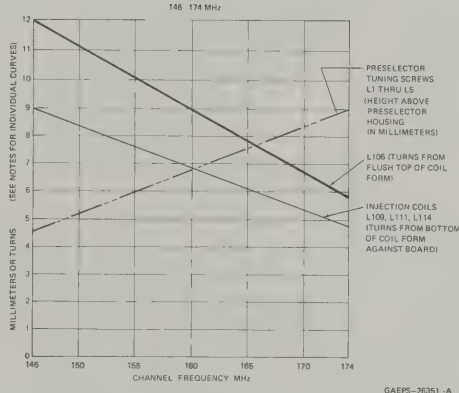
STEP	TEST SET METER POSITION	ADJUST	PROCEDURE
1		L1-L5	Preset the RF preselector tuning screws per the preset chart.
2		L109, L111, L114	Preset the injection string coil slugs per the preset chart.
3		L106	Preset the mixer gate coil per the preset chart. <i>This is the only tuning performed on this coil. Preset carefully.</i>
4		L107	Preset mixer drain coil slug 10 turns from flush with top of coil form.
5		L204, L206	Preset the i-f matching network coil slugs 8 turns from flush with top of coil form.
6	2 (Reverse)	L208	Starting with the slug flush with top of coil form, adjust the detector coil for the <i>first</i> reading of 24 uA on meter 2. (No input signal is necessary). Perform Step 7A for radios with maximum receive frequency separation of 0.5 MHz or less; perform Step 7B for radios with maximum receive frequency separation greater than 0.5 MHz.
7A	6	L109, L111, L114	Adjust the injection string coils for peak reading on meter 6 with the <i>lowest</i> frequency selected. Repeat until no further improvement is obtained.
7B	6	L109, L111, L114	Adjust the injection string coils for peak reading on meter 6 with the <i>highest</i> frequency selected. Repeat until no further improvement is obtained. Tune L109 for peak meter 6 reading with the <i>lowest</i> frequency selected. Repeat L114 and L111 for peak on <i>highest</i> frequency and L109 on <i>lowest</i> frequency until no further improvement is obtained.
8	1 (Reverse), 4	Receiver Oscillator Warp	For each frequency, set rf generator to the carrier frequency (± 100 Hz) and adjust the output level for a meter 1 reading of 35 uA. Activate the meter 4 circuit by shorting the meter 4 enable pins. Adjust oscillator frequency for a zero reading on meter 4.
9	1 (Reverse)	L1-5 (and L153 with Preamp)	Adjust L1, L2, (L153), L3, L4, L5 in order for peak reading on meter 1 using the <i>highest</i> frequency and maintaining meter 1 between 30 and 40 uA by adjusting the signal generator output. Repeat until no further improvement is obtained. Perform Step 10 <i>only</i> for radios with maximum receive frequency separation greater than 0.5 MHz.
10	1 (Reverse)	L1-1.5 (and L153 with preamp)	Adjust L1, L2, (L153), L3, L4, L5 <i>once</i> in that order for peak reading on meter 1 using the <i>lowest</i> frequency and maintaining meter 1 between 30 uA and 40 uA by adjusting the signal generator output.
11	1 (Reverse)	L107, L204, L206	Apply standard test modulation (1 kHz tone, ± 3 kHz deviation) to the rf signal generator and adjust the output level for 35 uA on meter 1. Adjust i-f coils for a peak reading on meter 1 while maintaining meter 1 between 30 uA and 40 uA by adjusting the generator output. Repeat until no further improvement is obtained.
12	7 (AC Voltmeter across the speaker)	L208	With the same conditions as in Step 11, adjust L208 <i>slowly</i> for maximum audio voltage across the speaker.
13	1 (Reverse), 4	Receiver Oscillator Warp	Repeat Step 8. Perform Step 14A for radios with maximum receive frequency separation of 0.5 MHz or less; perform Step 14B for radios with maximum receive frequency separation greater than 0.5 MHz.
14A	AC Voltmeter across speaker	L5 (or L1, L2 with Preamp)	Adjust L5 (or L1 and L2 in Preamp Radios) for best quieting with the highest frequency selected. Receiver tuning is now complete.
14B	AC Voltmeter across Speaker	L1-1.5 (Do not adjust L153 in preamp radios)	Check 20 dB quieting sensitivity on all frequencies. <i>If necessary</i> , retune L1 and L2 <i>once</i> on highest frequency for best quieting. Check sensitivities again and <i>if necessary</i> retune L3-5 <i>once</i> , on the lowest frequency, for best quieting. Tuning is complete.

RECEIVER METERING TABLES

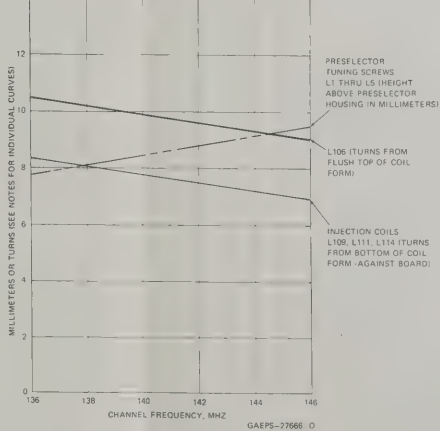
- Meter readings reflect no signal applied after proper alignment.
- When dial readings are shown the reading before the / is without preamplifier and the reading after the / is with preamplifier.

PORTABLE TEST SET SWITCH POSITION	1	2	4	6
METER READING (uA)	12/14 (min) 30/32 (max)	20 (min) 28 (max)	0 (nom)	10 (min)
FUNCTION METERED	Signal Strength	Detector D.C. Output	Carrier Offset	Injection Level

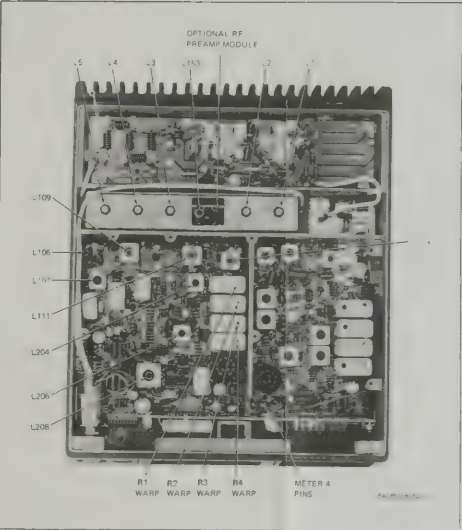
146-174 MHz



136-146 MHz



Receiver Preset Charts



High Band MITREK Receiver Alignment Locations

HIGH BAND MITREK
RECEIVER ALIGNMENT AND
TEST EQUIPMENT LIST

DEVIATION ADJUSTMENT

NOTE

The oscillator frequency adjustment *must* be made *prior* to this adjustment.

Step 1. Connect the output leads of the tone oscillator through a 0.33 uF capacitor to the transmitter audio input (microphone receptacle).

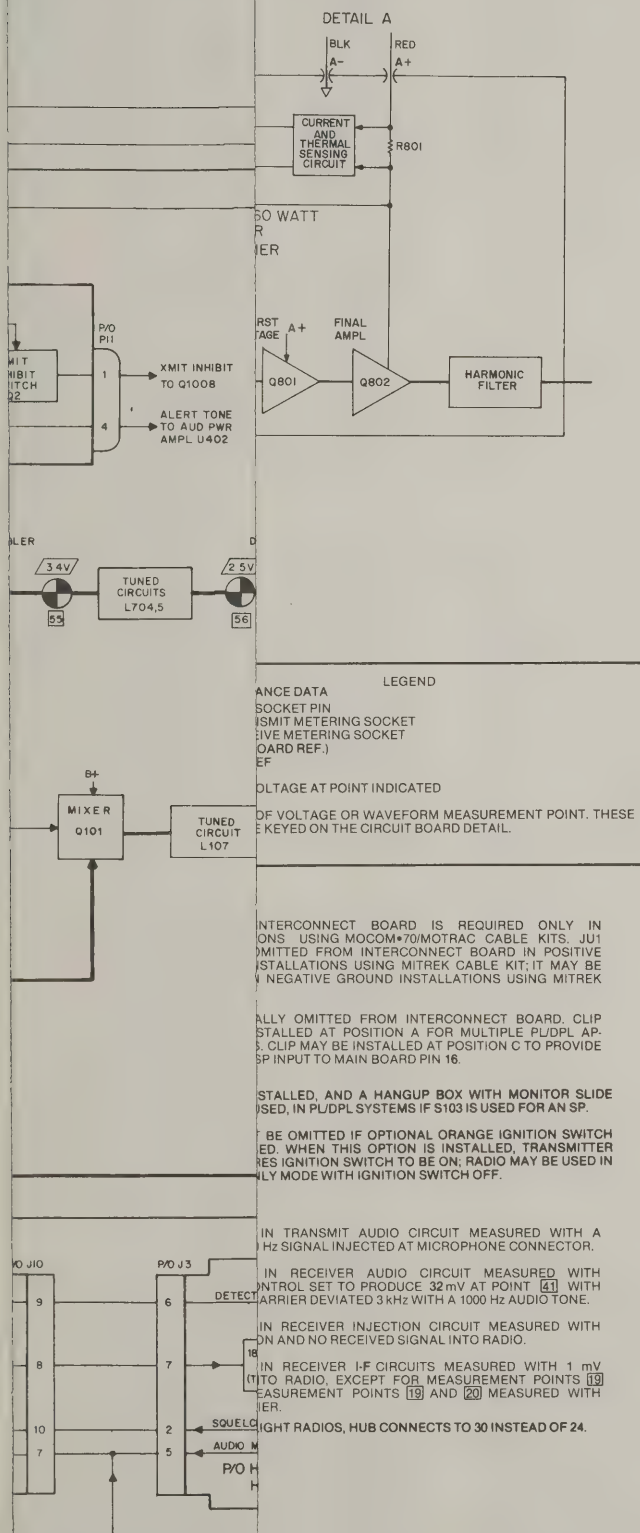
Step 2. Connect the ac voltmeter across the tone oscillator output and adjust the tone generator output to 1 volt at 1000 Hz.

Step 3. Key the transmitter and adjust the F1 deviation adjust control for 4.8 kHz deviation. *For multiple frequency models* adjust the F2, F3, and F4 deviation adjust controls with the frequency selector switch in the corresponding position.

Step 4. "Private-Line" deviation should now be between 0.5 to 1.0 kHz.

High Band Transmitter Alignment Procedure (75 W or 110 W Models Only)

Step	Test Switch Position	Adjustment	Procedure
1	None	Freq. Select	Adjust to lowest frequency channel, F min, for multiple frequency model.
		L701 — L708	Turn all coil slugs to flush with top of can. Then, preset L701 and L703 to 7 turns in from top of can.
		L707, L708	Preset L707 and L708 per the preset table.
		R909, R911, R826	Adjust fully clockwise.
		C734	Preset to 2 turns from tight.
2	M3	L701, L702, L703	Peak L702, then peak L701, L702, L703 until no further improvement is obtained.
3	M3	L704, L705	Dip L704, then peak L705.
4	M5	L706, L707, L708, L704, L705.	Peak L706, L707, L708, L704, and L705, in that order. If necessary, adjust R911 to prevent M5 saturation.
5	Wattmeter	C734, R911	Peak power output with C734. Adjust R911 to 125 W (75 W models) or 130 W (110 W models).
6	M5	L707, L708	Peak L707 and L708.
7	Wattmeter	R911, C734	Adjust R911 to 125 W (75 W models) or 130 W (110 W models). Peak power output with C734.
If transmitter is tuned for a single frequency, or a maximum separation of less than 500 kHz, skip to Step 14.			
8	M3	L702	Select the <i>highest</i> frequency channel, F max and peak L702.
9	M5	L704, L706	Peak L704 and L706.
10	M3	L701, L703	Select the <i>lowest</i> frequency channel, F min. Peak L701 and L703.
11	M5	L705, L707	Peak L705 and L707.
12	Wattmeter	R911	While monitoring output power on all channels, adjust R911 so that the minimum output power among all channels is 92 W (75 W models) or 130 W (110 W models).
13	Wattmeter, M5	R911, L708	Adjust L708 for equal M5 reading on F min and F max. While adjusting L708, reset R911, if necessary, to maintain the minimum power levels stated, in Step 12. If balancing of M5 is not possible, peak L708 on the channel with the lowest M5 reading.
14	Wattmeter, M5	R911	Select the channel with the <i>lowest</i> power output (multiple frequency models only). Adjust R911 for output of 125 W for 75 W models or 130 W for 110 W models. Note M5. Readjust R911 to <i>increase</i> M5 by 2 microamperes.
15	Wattmeter	R826	While monitoring output power on all channels, adjust R826 so that the minimum output power among all channels is 125 W (75 W models) or 130 W (110 W models).
16	Wattmeter	R909	While monitoring output power on all channels, adjust R909 so that the minimum output power among all channels is 82 W (75 W models) or 120 W (110 W models).



HIGH BAND MITREK TRANSMITTER ALIGNMENT

FREQUENCY CALCULATIONS

FREQUENCY (MHz)	CALCULATION
136-174 MHz	$f_o = \frac{f_c}{12}$

Where f_O = crystal frequency, f_c = carrier frequency

Preset Table for L707 and L708			
136-146 MHz Models	#Of Turns From Top of Coil Can	146-174 MHz Models	Frequency of F min
6 Turns	136-146 MHz	8 Turns	146-155 MHz
		7 Turns	From Above 155 to 165 MHz
		6 Turns	From Above 165 to 174 MHz

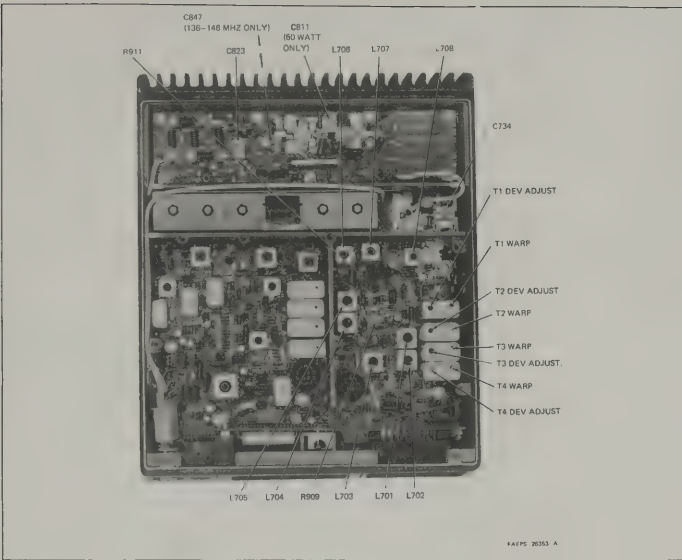
Transmitter Alignment Procedure
Motorola No. PEPS-26662-E
8/1/82-TP

CAUTION
In positive ground systems the case of the TEK5 Meter Panel and portions of the S1056B Portble Test Set are hot with respect to the vehicle chassis due to the nature of the positive ground installation. Take necessary precautions that the test equipment does not contact the vehicle chassis.

High Band Transmitter Alignment Procedure (40 W or 60 W Models Only)			
Step	Test Switch Position	Adjustment	Procedure
1	None	Freq. Select	Adjust to lowest frequency channel, F min, for multiple freq. models.
		L701 — L708	Turn all coil slugs to flush with top of can. Then, preset L701 and J703 to 7 turns in from top of coil can.
		L707, L708	Preset L707 and L708 per the preset table.
		R909, R911	Adjust fully clockwise.
		C734, C811, C823, C847	Preset to 2 turns from tight for C734, 1 turn from tight for C811, C823 or C847.
2	M3	L701, L702, L703	Peak L702, then peak L701, L702, L703 until no further improvement.
3	M3	L704, L705	Dip L704, peak L705.
4	M5	L706, L707, L708, L704, L705	Peak L706, L707, L708, L704, and L705, in that order. If necessary, adjust R911 to prevent M5 saturation.
5	Wattmeter	C734, C811, C823, C847	Peak power out with C734. Also peak C811 and C823 on 146-174 MHz 60 W models or C847 on all 136-146 MHz models.
6	Wattmeter	R911	Adjust R911 to 70 W for 60 W models, 47 W for 40 W Models, 40 W for 30 W models. Set R911 to the appropriate extreme position if this power level cannot be achieved.
7	M5	L707, L708	Peak L707, L708.
8	Wattmeter	C734	Peak C734.
Steps 9-11 apply to wide-spaced radios only. If transmitter is to be tuned for a single frequency, or a separation of less than 500 kHz, skip to Step 16 (136-146 MHz models) or to Step 18 (146-174 MHz models).			
9	M3	L702	Select the highest frequency channel Fmax. Peak L702.
10	M5	L704, L706	Peak L704 and L706.
11	M3	L701, L703	Select the lowest frequency channel, Fmin. Peak L701 and L703.
12	M5	L705, L707	Peak L705 and L707.
13	M5	L708, frequency select.	Adjust L708 such that the reading on M5 is the same on Fmin and Fmax. If this is not possible, peak L708 on the channel with the lowest M5 reading.
Steps 14-15 apply to 60-watt wide-spaced radios only. For 30/40 Watt (136-146 MHz models) skip to Step 16. For 40 Watt (146-174 MHz models) skip to Step 18.			
14	Wattmeter	R911, R909	Adjust R911 fully clockwise. For 136-146 MHz models select channel with lowest power. For 146-174 MHz models select channel with highest power. Adjust R909 for 68 watts out.
15	Wattmeter	C823, C847, R909	Adjust C823 or C847 so that output power of Fmin and Fmax are within 3 watts of each other. For 136-146 MHz models adjust C847 in direction of increasing power. After adjusting C823 or C847, turn R909 fully clockwise.
Steps 16-17 apply to 136-146 MHz radios only. If transmitter frequency is between 146-174 MHz skip to Step 18.			
16	Wattmeter	R911	Select channel with the lowest power out (multiple frequency models only). Adjust R911 for 68, 50 or 40 watts out for 60, 40 or 30 watt models, respectively. Recheck all channels and if necessary, readjust R911 until lowest power channel yields the power level stated above.
17	Wattmeter	R909	Adjust R909 for 64, 44 or 34 watts out for 60, 40 or 30 watt models, respectively. Select channel with lowest power out (multiple frequency models only). If power is less than 62, 43 or 33 watts for 60, 40 or 30 watt models, respectively, then readjust R909 for that minimum power.
This completes the alignment of 136-146 MHz transmitter models.			
18	Wattmeter	R911	Select the channel with the highest power output (multiple frequency models only). Adjust R911 to 70 W (60 W models) or 47 W (40 W models). If power output cannot be reduced to 70 W or 47 W, adjust R911 to fully counterclockwise.
19	Wattmeter	R909	Adjust R909 to 65 W (60 W models) or 44 W (40 W models).
This completes the alignment of 146-174 MHz transmitter models.			

NOTE
The tuning procedure should be performed using the Motorola portable test set or the TEK5 set to position A.

CAUTION
Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

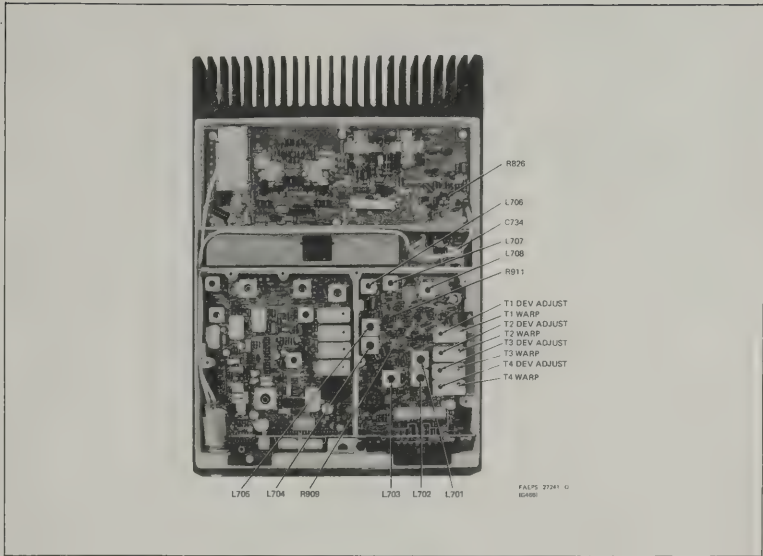


High Band MITREK Transmitter Ajustment Locations
(40 and 60 Watt Models)

FINAL METER READINGS

- Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
- All readings given in the following table are minimum (based on a nominal dc supply voltage of 13.6 volts) except M7 (PA current) which is a nominal reading.
- The readings at M3 and M5 are purely relative and do not give actual current or voltage measurements.
- Multiple the microampere scale reading obtained at M7 by 0.6 (40 W), 0.8 (60 W), or 1.3 (75 and 110 W) to determine the actual final amplifier current in amperes.

Transmitter Metering Tables				
S1056B-9B Series Switch Position	3	5	7	
Meter Reading	15 uA (min)	10 uA (min)	9-13 uA (40 watt models) 9-15 uA (60 watt models) 9-15 uA (75 watt models) 11-19 uA (110 watt models)	
Circuit Metered	Oscillator Output	First Amplifier Output	Final Amplifier Current	



Transmitter Adjustment Locations (75 and 110 watt models)

OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator “on frequency” should be done *after* the transmitter has been aligned, but *before* transmitter deviation is checked and set. In addition, it is essential that the bottom shield is in place when this adjustment is made. Set the oscillator on frequency and perform the following steps:

Step 1. Set the frequency selector switch to the F1 position (multi-frequency units only).

Step 2. Key the transmitter with no modulation using the portable test set. On “Private-Line” and “Digital Private-Line” radios, disable the encoder output by shorting the code disable points.

Step 3. Adjust T1 warp control for proper readings on the frequency meter. If the frequency, as indicated on the frequency meter, is too low; then turn the warp control counterclockwise; if too high, turn clockwise. Set frequency within ± 75 Hz.

NOTE
Omit Steps 4 & 5 for single frequency units.

Step 4. Set the frequency selector switch to the F2 position and repeat Step 3 using T2 warp control.

Step 5. Repeat Step 4 for F3 and F4 using T3 and T4 warp controls, respectively.

DEVIATION ADJUSTMENT

NOTE
The oscillator frequency adjustment *must* be made *prior* to this adjustment.

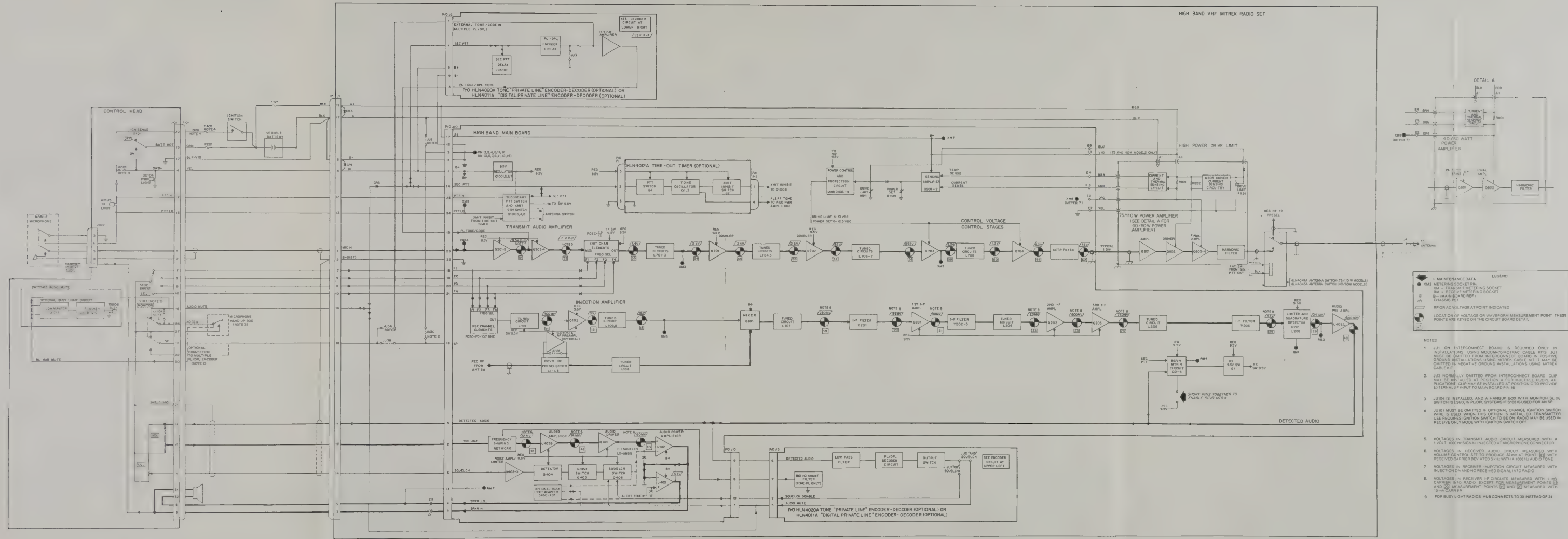
Step 1. Connect the output leads of the tone oscillator through a 0.33 uF capacitor to the transmitter audio input (microphone receptacle).

Step 2. Connect the ac voltmeter across the tone oscillator output and adjust the tone generator output to 1 volt at 1000 Hz.

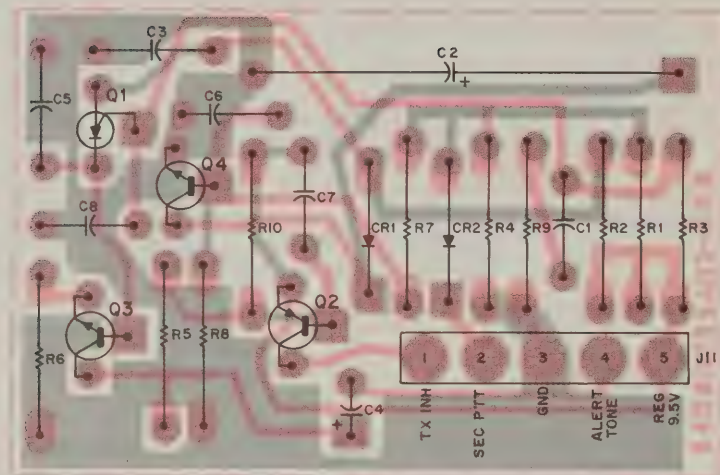
Step 3. Key the transmitter and adjust the F1 deviation adjust control for 4.8 kHz deviation. *For multiple frequency models* adjust the F2, F3, and F4 deviation adjust controls with the frequency selector switch in the corresponding position.

Step 4. “Private-Line” deviation should now be between 0.5 to 1.0 kHz.

High Band Transmitter Alignment Procedure (75 W or 110 W Models Only)			
Step	Test Switch Position	Adjustment	Procedure
1	None	Freq. Select	Adjust to lowest frequency channel, F min, for multiple frequency model.
		L701 — L708	Turn all coil slugs to flush with top of can. Then, preset L701 and L703 to 7 turns in from top of can.
		L707, L708	Preset L707 and L708 per the preset table.
		R909, R911, R826	Adjust fully clockwise
		C734	Preset to 2 turns from tight.
2	M3	L701, L702, L703	Peak L702, then peak L701, L702, L703 until no further improvement is obtained.
3	M3	L704, L705	Dip L704, then peak L705.
4	M5	L706, L707, L708, L704, L705.	Peak L706, L707, L708, L704, and L705, in that order. If necessary, adjust R911 to prevent M5 saturation.
5	Wattmeter	C734, R911	Peak power output with C734. Adjust R911 to 125 W (75 W models) or 130 W (110 W models).
6	M5	L707, L708	Peak L707 and L708.
7	Wattmeter	R911, C734	Adjust R911 to 125 W (75 W models) or 130 W (110 W models). Peak power output with C734.
If transmitter is tuned for a single frequency, or a maximum separation of less than 500 kHz, skip to Step 14.			
8	M3	L702	Select the <i>highest</i> frequency channel, F max and peak L702.
9	M5	L704, L706	Peak L704 and L706.
10	M3	L701, L703	Select the <i>lowest</i> frequency channel, F min. Peak L701 and L703.
11	M5	L705, L707	Peak L705 and L707.
12	Wattmeter	R911	While monitoring output power on all channels, adjust R911 so that the minimum output power among all channels is 92 W (75 W models) or 130 W (110 W models).
13	Wattmeter, M5	R911, L708	Adjust L708 for equal M5 reading on F min and F max. While adjusting L708, reset R911, if necessary, to maintain the minimum power levels stated, in Step 12. If balancing of M5 is not possible, peak L708 on the channel with the lowest M5 reading.
14	Wattmeter, M5	R911	Select the channel with the <i>lowest</i> power output (multiple frequency models only). Adjust R911 for output of 125 W for 75 W models or 130 W for 110 W models. Note M5. Readjust R911 to <i>increase</i> M5 by 2 microamperes.
15	Wattmeter	R826	While monitoring output power on all channels, adjust R826 so that the minimum output power among all channels is 125 W (75 W models) or 130 W (110 W models).
16	Wattmeter	R909	While monitoring output power on all channels, adjust R909 so that the minimum output power among all channels is 82 W (75 W models) or 120 W (110 W models).



TIME-OUT TIMER



SHOWN FROM SOLDER SIDE

SOLDER SIDE BD-BEPS-26132-8
COMPONENT SIDE BD-BEPS-26133-8
OL-BEPS-26131-8

parts list

HLN4012A Time-Out Timer

PL-6032-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed:		
C1	21-82372C10	.05 uF + 80-20%; 25 V
C2	23-83185D01	120 uF ± 10%; 15 V
C3	8-84637L38	.0033 uF ± 10%; 630 V
C4	23-84538G01	1 uF ± 20%; 35 V
C5	8-84637L32	.0068 uF ± 10%; 630 V
C6, 7	21-83596E10	220 pF ± 20%; 500 V
C8	21-82187B44	.001 uF ± 10%; 100 V
diode: (see note)		
CR1, 2	48-83654H01	silicon
connector, receptacle:		
J11	9-80098A01	female, 5 contact
transistor: (see note)		
Q1	48-869673	Thyristor; type M9673
Q2	48-869467	PNP; type M9467
Q3, 4	48-869642	NPN; type M9642
resistor, fixed: ± 10%, 1/4 W;		
unless otherwise stated		
R1	6-124C71	8.2k
R2	6-124B11	360k ± 5%
R3	6-124A89	47k ± 5%
R4	6-124A97	100k ± 5%
R5	6-124A53	1.5k ± 5%
R6	6-124C33	220
R7	6-124C73	10k
R8	6-124A61	3.3k ± 5%
R9	6-124C77	15k
R10	6-124A49	1k ± 5%

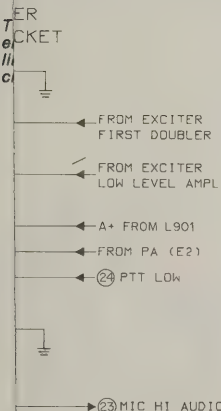
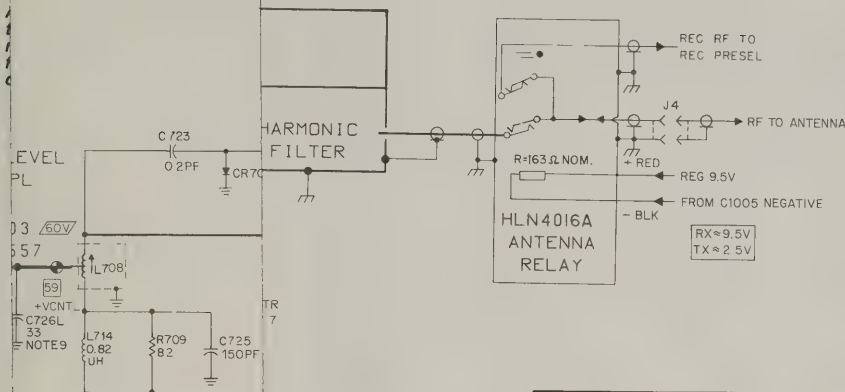
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

-EEPS-29773-0
-EEPS-29774-0
-EEPS-27408-8
-EEPS-274 11-0

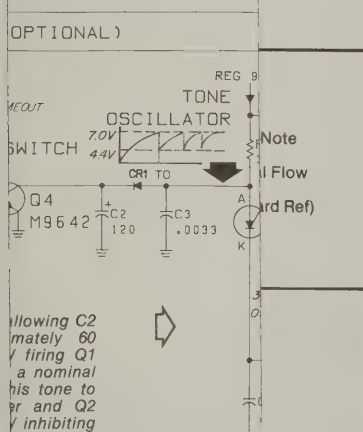
MITTED
ON USED

HIGH BAND MITREK RADIO

TRANSMITTER SECTION



...es and maintains a constant
to the power amplifier final
T801 senses PA temperature
es final amplifier stage cur-
decrease above a given
re to maintain the PA in a
ting condition.



allowing C2
imately 60
firing Q1
a nominal
his tone to
r and Q2
inhibiting

VOLTAGE NOTES

1. DC voltages measured with 20 K-ohm/volt multimeter referenced to B-. When measuring transmitter voltages use 33 uH choke in series with meter input.
2. Indicates ac voltage levels at points indicated.
3. Supply voltage during receive mode is 13.8 V. Supply voltage during transmit mode is 13.6 V.
4. Voltage keys:
USQ Receiver unsquelch
FSQ Receiver in full squelch
TX Radio keyed
RX Radio not keyed
5. Waveforms in transmit audio amplifier circuit taken with a 1.0 V 1000 Hz sinewave signal applied at microphone input.
6. Indicates voltage or waveform measurement point. These points are keyed on the circuit board detail.

NOTES:

1. Unless otherwise indicated: Resistor values are in ohms; Capacitor values are in microfarads.
2. Only the protection circuit portion of the power amplifier is shown on this diagram. See the applicable separate power amplifier and harmonic filter schematic diagram for the complete circuit.
3. Points shown as ①, ②, etc. are connected to the interconnect board for distribution to other points in the radio.
4. JU601-JU605 installed as required to bus 2 or more channel select lines to a single channel element when those channels use the same receive frequency.
5. Frequency calculation: $F_{osc} = F_c/12$.
6. Frequency range sensitive part. Indicated value is for 146-174 MHz radios. See parts list for 136-148 MHz part values.
7. Circuitry shown in dashed box is used in 75 and 110 watt power amplifiers only.
8. E7, E8 & E9 used in 75 and 110 watt radios only.
9. Used in HLD4001 only; (136-148 MHz)

HIGH BAND MITREK RADIO
TRANSMITTER SECTION BOARD DETAIL

Reference Series Key	
REFERENCE	CIRCUIT
0-99	Receiver Meter 4, Receiver 9.5 V Switch
100-199	Receiver Injection and Receiver rf
200-299	IF
300-399	—
400-459	Detector, Receiver Audio, Squelch
460-480	Busy Light Adapter
500-599	Transmit Audio
600-699	Transmit and Receive Channel Elements
700-799	Exciter
800-899	Power Amplifier
900-999	Power Control and Protection
1000-1099	Regulator, Transmitter 9.5 V Switch, PTT

parts list

P/O HLD4001C Main Board Transmitter Section RI (L = 136-146 MHz)
P/O HLD4002B Main Board Transmitter Section RII (H = 146-174 MHz)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C501	21-83596E36	capacitor, fixed pF ± 5%; 500 V; .01 uF ± 40-40%; 200 V
C502	21-83596E10	220 ± 20%
C503, 504	8-84637L31	.047 uF ± 10%; 250 V
C505, 506	21-83596E10	220 ± 20%
C507	8-84406D03	.01 uF ± 10%; 50 V
C508	8-82905G40	.030 uF ± 5%; 50 V
C509	8-83819H44	.0012 uF ± 5%; 100 V
C511	23-84665F03	100 uF ± 100-10%; 25 V
C602	21-84448K02	.01 uF ± 20%; 100 V
C701L	21-84493B56	47, 100 V
C701H	21-83406D82	36
C702L	21-82450B18	2
C702H	21-82450B13	1.5
C703L	21-80067A54	47
C703H	21-83406D82	36
C704L	21-82450B18	2
C704H	21-82450B13	1.5
C705L	21-83798B17	100; 200 V
C705H	21-84493B23	120
C706L	21-84493B11	100; 200 V
C706H	21-84493B14	66; 200 V
C707, 708	21-83596E13	.001 uF ± 10%; 100 V
C709	21-83406D80	4.7 ± 25 pF
C710	21-83596E13	.001 uF ± 10%; 100 V
C711	21-83596E36	.01 uF ± 40-40%; 200 V
C712L	21-83406D87	22
C712H	21-80171A36	16; N330
C713L	21-82450B08	1.2
C713H	21-82450B39	0.91
C714L	21-83406D87	45
C714H	21-83406D56	24
C715L	21-83406D87	43
C715H	21-80067A54	56
C716, 717	21-83596E13	.001 uF ± 10%; 100 V
C718L	21-80170A32	13; N220
C718H	21-80170A24	9; N220
C719L	21-82450B13	1.5
C719H	21-82450B47	1.0
C720H, 721H	21-80067A29	11 ± 5 pF
C720L	21-83406D83	16
C721L	21-83406D56	24
C722	21-83596E13	.001 uF ± 10%; 100 V
C723	21-82450B35	0.2 ± 10%

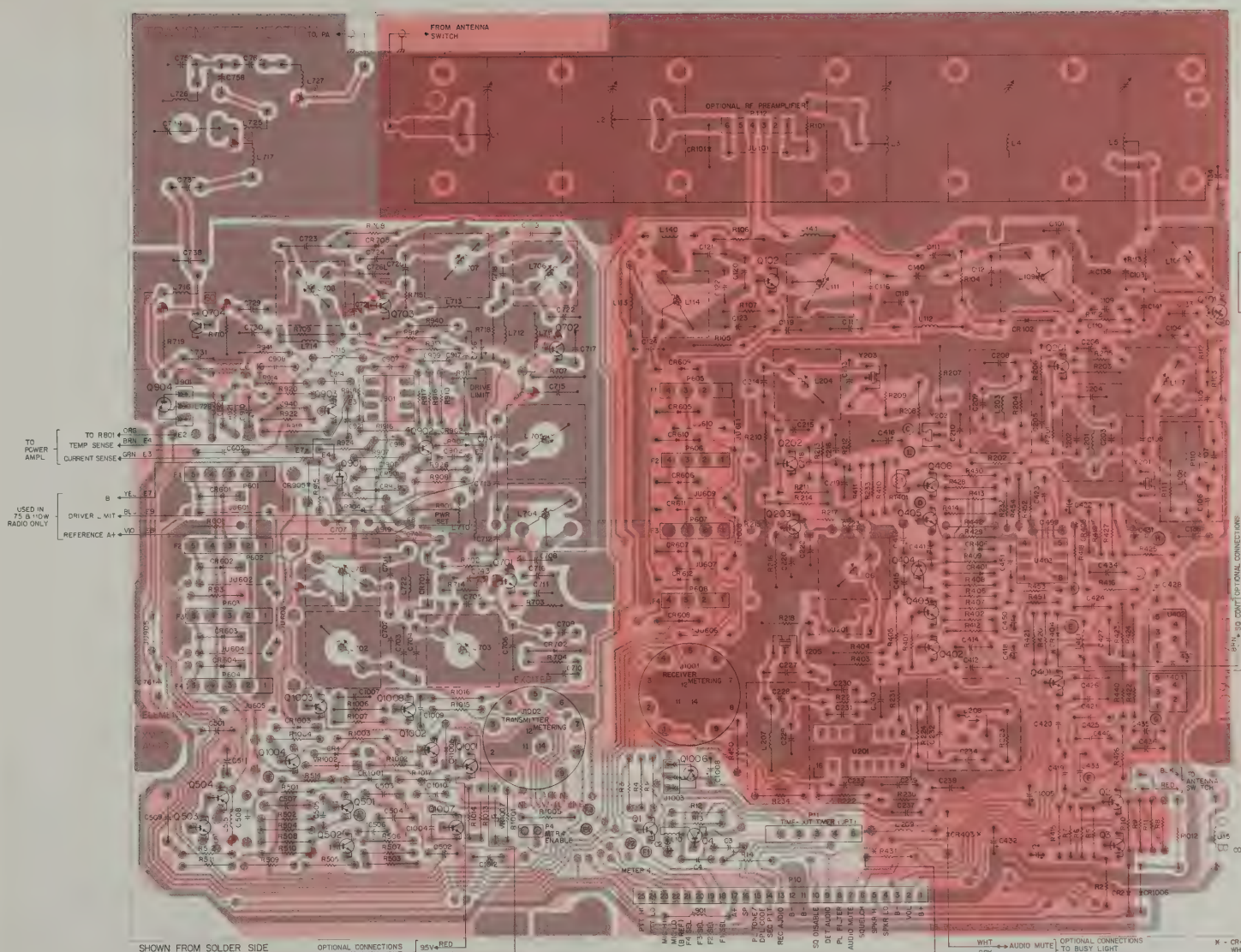
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(Sheet 1 of 5)
8/1-82/PT

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C724	21-83596E13	.001 uF ± 10%; 100 V
C725	21-82204B54	50; 200 V
C726L	21-83406D71	33
C726H	—	NOT USED
C729L	21-82204B76	16; N470
C729H	21-80171A28	10; N330
C730H	21-84493B27	51; 200 V
C730L	21-83406D71	33
C731	21-82372C10	.05 uF ± 20%; 25 V
C734	20-84579B11	variable; 7.57 pF; 100 V
C737	21-83596E10	220 ± 20%
C738L	21-84857K32	180 pF ± 5%
C738H	21-83596E36	.01 uF ± 60-40%; 250 V
C743	21-83596E13	.001 uF ± 10%; 100 V
C747	21-82372C09	.01 uF ± 80-20%; 25 V
C756	23-84538C03	.01 uF ± 20%; 35 V
C758L	21-83406D70	8
C758H	21-82204B03	6
C759L	21-84493B27	51; 200 V
C759H	21-84493B38	39
C760L	21-83406D70	100; 200 V
C760H	21-82204B03	6
C761	21-82372C10	.05 uF ± 20%; 25 V
Q802, 907	21-82187B44	.001 uF ± 10%; 100 V
Q908	21-84637L31	.047 uF ± 10%; 250 V
Q909	21-82187B44	.001 uF ± 10%; 100 V
Q910	23-84538C06	.01 uF
Q914	21-82372C10	.05 uF; 25 V
Q916	23-84538C24	0.56 uF
Q917	21-82187B44	.001 uF ± 10%; 100 V
Q919	21-82372C10	.05 uF ± 20%; 25 V
Q921	21-83596E10	220 pF ± 20%
Q940	21-83596E10	220 ± 20%
C1004	21-83596E37	.01 uF ± 70-30%; 100 V
C1005	23-84665F02	15 uF ± 100-10%; 25 V
C1007	21-82372C10	.05 uF ± 20%; 25 V
C1008	23-84665F03	100 uF ± 100-10%; 25 V
C1009	21-844163	.0015 uF ± 25%; 250 V
C1010	21-83596E36	.01 uF ± 80-20%; 200 V
C1012	21-83596E36	.01 uF ± 80-40%; 250 V
C1901	21-82372C10	.05 ± 20%; 25 V
C1921	21-83596E10	220 ± 20%
CR601 thru 604	48-83654H01	diode; (see note)
CR701	48-82466H13	silicon
CR702	48-82139C01	germanium
CR705	48-82139C01	germanium
CR801	48-82466H13	silicon
CR902	48-82466H13	silicon
CR905	48-83654H01	silicon
CR907	48-82466H13	silicon
CR908	48-82466H13	silicon
CR1001	48-83654H02	silicon
CR1003	48-83654H01	silicon
CR1005	48-83654H01	silicon
CR1006	48-82466H13	silicon
J901	9-80028A01	connector, receptacle: female; 3 contact
J1002	9-80274G01	female; 12 contact
J1003	9-80028A01	female; 3 contact
L515	24-80036A02	coil; choke, 1/2 turn
L701	24-83377G11	6 1/2 turns (VIO)
L702, 703	24-80068A17	6 1/2 turns (YEL)
L704	24-80068A18	4 1/2 turns (ORG)
L705	24-80068A19	4 1/2 turns (WHT)
L706	24-80034A02	3 1/2 turns (WHT)
L707	24-80034A03	3 1/2 turns (RED)
L708	24-80034A03	3 1/2 turns (ORG)
L710	24-82835C13	choke; 0.82 uH
L711	24-83977B02	choke; 2 1/2 turns
L712	24-82835C13	choke; 0.82 uH
L713	24-83961B01	choke; 3 1/2 turns
L714	24-82835C13	choke; 0.82 uH
L715	24-83961B01	3 1/2 turns
L716	24-84411B03	11 1/2 turns (BRN)
L717	21-83596E13	3 1/2 turns (PRNK)
L722	24-82835C13	choke; 0.82 uH
L725	24-84411B04	10 1/2 turns (ORG)
L726	24-83840C07	2 1/2 turns (GRN)
L727	24-84411B04	10 1/2 turns (ORG)
L728	24-82835C13	choke; 0.82 uH
L901	24-82835C23	choke; .33 uH
P601 thru 604	28-80096A02	connector, plug; male; 5 contact
Q501	48-869643	transistor; (see note)
Q502, 503	48-869642	PNP; type M9643
Q504	48-869643	PNP; type M9643
Q701	48-869644	PNP; type M9644
Q702	48-869638	PNP; type M9638
Q703	48-869657	PNP; type M9657
Q704	48-869659	PNP; type M9659
Q705	48-869652	field-effect; type M9652
Q902	48-869643	PNP; type M9643

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q903	48-869642	NPN; type M9642
Q904	48-84411L10	PNP; type M1110
Q1001, 1002	48-869642	NPN; type M9642
Q1003	48-869660	NPN; type M9660
Q1004	48-869643	PNP; type M9643
Q1006	48-84411L10	PNP; type M1110
Q1007	48-869642	NPN; type M9642
Q1008	48-869643	PNP; type M9643
R501	6-124C43	resistor, fixed; ± 10%; 1/4 W; unless otherwise stated
R502, 503	6-124C83	560
R504, 505	6-124A13	27k
R506, 507	6-124C93	33 ± 5%
R508, 509	6-124C73	68k
R510	6-124A69	10k
R511, 512	6-124A70	6.8k ± 5%
R513	6-124C43	7.5k ± 5%
R514	6-124C01	560
R601	6-124C85	10
R702	6-124A89	4.7k
R703	6-124C05	62k ± 5%
R704	6-124C73	15
R707	6-124C73	10k
R708	6-124C75	47
R709	6-124C23	12k
R710	6-124C03	82
R714	6-124A49	12
R715	6-124A49	1k ± 5%
R718	6-124C25	82
R719	6-124C27	100
R905	6-125C31	180; 1/2 W
R907	6-124C81	22k
R908	6-124C55	1.8k
R909	18-80268B02	variable; 5k
R910	6-124C87	39k
R911	18-80268B05	variable; 50k
R912	6-124A73	18k ± 5%
R913	6-124A73	10k ± 5%
R914	6-124A97	100k ± 5%
R915	6-124C27	120
R916, 917	6-124C85	4.7k
R918	6-124C39	390
R919	6-125C29	150; 1/2 W
R920	6-124C25	10k
R921	6-124C43	560
R922	6-124C49	1k
R924	6-124C29	150 ± 5%
R926	6-124A33	220 ± 5%
R927	6-124C67	5.6k
R940	6-124A90	51k
R941	6-124A49	1k
R1001	6-124C53	1.5k
R1002	6-124A22	75 ± 5%
R1003	6-124A19	56 ± 5%
R1004	6-124C53	1.5k
R1005	6-124C73	10k
R1006	6-124C49	1k
R1007	6-124C73	10k
R1012	6-125C03	12; 1/2 W
R1013	6-124C49	1k
R1014	6-124C73	10k
R1015	6-124C67	5.6k
R1016	6-124C67	5.6k
R1017	6-124C39	390
R1018	6-124C53	560 ± 10%
U901	51-84621K70	integrated circuit; (see note) type M2170
VR004	48-82256C51	voltage regulation: 3Zener type: 5.1 V
VR1002	48-82256C44	3Zener type: 7.5 V
VR1007	48-83461E18	3Zener type: 16 V
mechanical parts		
28-80196A01	CAN, coil for L701-L705	
28-80039A01	CAN, coil for L706-708	
14-80001C01	INSULATOR FOR Q703, Q704	

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

HLN4045A Antenna Switch is not field repairable and replacements should be ordered as a unit.

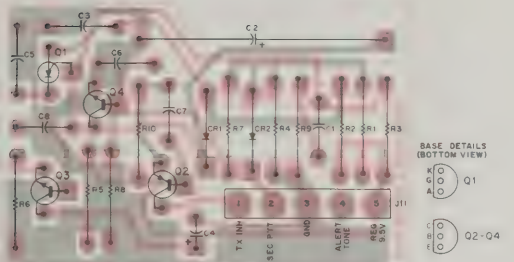


SQUARE PAD ON PC BOARD INDICATES
1 1GAGE SOCKET
2 BASE OF TRANSISTOR
3 CATHODE OF DIODE
4 POSITIVE LEAD OF ELECTROLYTIC CAPACITORS

SCHEMATIC DIAGRAM
WHIT → AUDIO MUTE
GRY → BUSY LIGHT
SQ → DISABLE ADAPTER BOARD

* CR403-4, R431, L401 OMITTED WHEN BUSY LIGHT OPTION USED

TIME-OUT TIMER



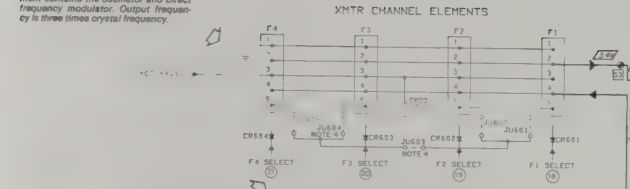
SHOWN FROM SOLDER SIDE

parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	21-82372C10	capacitor, fixed: .05 uF ± 80-20%; 25 V
C2	23-83185D01	120 uF ± 10%; 15 V
C3	8-84637L38	.0033 uF ± 10%; 630 V
C4	23-84538G01	1 uF ± 20%; 35 V
C5	8-84637L32	.0058 uF ± 10%; 630 V
C6, 7	21-83596E10	220 pF ± 20%; 500 V
C8	21-82187B44	.001 uF ± 10%; 100 V
CR1, 2	48-83654H01	diode; (see note) silicon
J11	9-80098A01	connector, receptacle: female; 5 contact
Q1	48-869673	transistor; (see note)
Q2	48-869667	PNP; type M9667
Q3, 4	48-869642	NPN; type M9642
R1	6-124C71	resistor, fixed: ± 10%; 1/4 W; unless otherwise stated
R2	6-124B11	8.2k
R3	6-124A89	300k ± 5%
R4	6-124A87	47k ± 5%
R5	6-124A53	100k ± 5%
R6	6-124C33	1.5k ± 5%
R7	6-124C73	10k
R8	6-124A81	3.3k ± 5%
R9	6-124C77	15k
R10	6-124A49	1k ± 5%

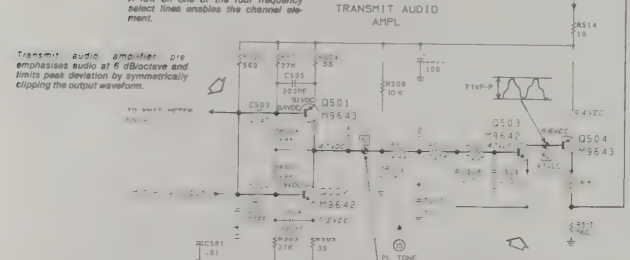
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

A channel element plugs into connector F1, F2, F3, F4. Each channel element contains the oscillator and direct frequency modulator. Output frequency is three times crystal frequency.



A tone on one of the four frequency select lines enables the channel element.

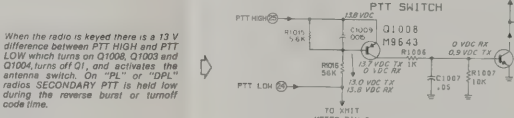
Transmit audio amplifier pre-emphasizes audio at 6 dB/octave and limits peak deviation by symmetrically clipping the output waveform.



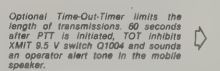
OSC3504 is active splitter filter. Attenuates audio above 3 kHz at more than 15 dB/octave.



When the radio is keyed there is a 13 V difference between PTT HIGH and PTT LOW which turns on Q1008, Q1003 and Q1004, turns off Q1, and activates the antenna switch. On "PL" or "DPL" radios, SECONDARY PTT is held low during the reverse burst or turnoff code time.



Optional Time-Out-Timer limits the length of transmissions 60 seconds after PTT is initiated. TOT inhibits XMIT 9.5 V switch Q1004 and sounds an operator alert tone in the mobile speaker.



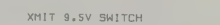
VR1002 with Q1002 provides load regulation and sets 9.5 V output. VR1007 with Q1007 provides over-voltage shut down of the 9.5 V regulator.



9.5V REGULATOR



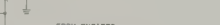
XMIT 9.5V SWITCH



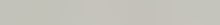
TX INHIBIT



TRANSMITTER METERING SOCKET



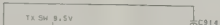
TOP VIEW OF TRANSMITTER METERING SOCKET J1002



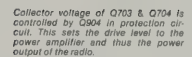
HLN 4012A TIME-OUT TIMER (OPTIONAL)



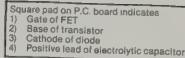
SEC PTT low turns off Q4 allowing C2 to charge. After approximately 60 seconds, C2 reaches 6.6 V firing Q1 which begins oscillating at a nominal 1000 Hz rate. Q3 applies this tone to the receive audio amplifier and Q2 clamps Q1004 base to 9.5 V inhibiting transmission.



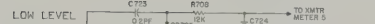
Collector voltage of Q703 & Q704 is controlled by Q804 in protection circuit. This sets the drive level to the power amplifier and thus the power output of the radio.



Square pad on P.C. board indicates: 1) Gate of FET 2) Base of transistor 3) Cathode of diode 4) Positive lead of electrolytic capacitors



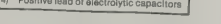
LOW LEVEL AMPL



DOUBLER



AMPLIFIER



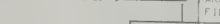
POWER CONTROL AND PROTECTION CONTROL AMPLIFIER



PA DRIVE REGULATOR



HIGH POWER PROTECTION AND CONTROL (NOTE 7)



POWER AMPLIFIER AND HARMONIC FILTER (NOTE 2)



HARMONIC FILTER



VOLTAGE NOTES

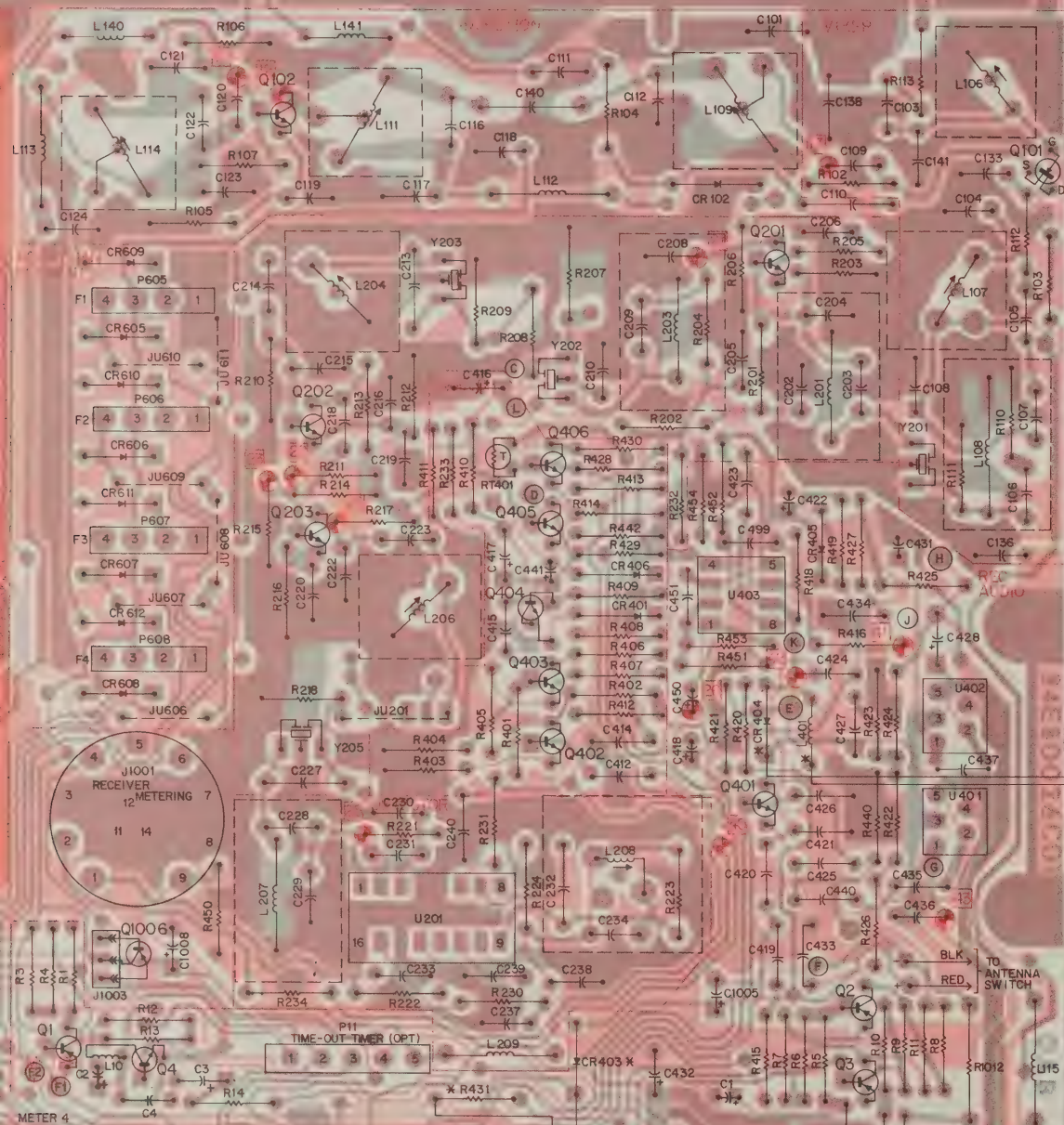
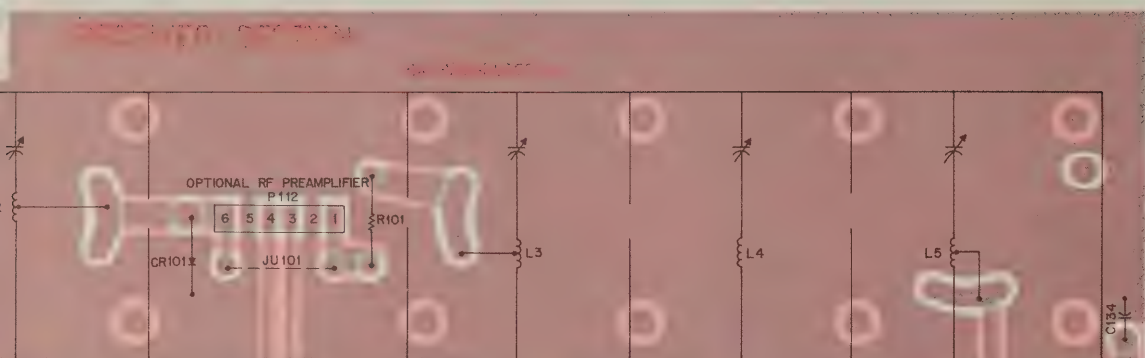
- 1. DC voltages measured with 20 K-ohm/volt multimeter referenced to B. When measuring transmitter voltages use 33 uH choke in series with meter input.
- 2. Indicates ac voltage levels at points indicated.
- 3. Supply voltage during receive mode is 13.8 V. Supply voltage during transmit mode is 13.6 V.
- 4. Voltage keys: USQ Receiver unswitched, FSQ Receiver in full squelch, TX Radio keyed, RX Radio not keyed.
- 5. Waveforms in transmit audio amplifier circuit taken with a 10 V 1000 Hz sinewave signal applied at microphone input.
- 6. Indicates voltage or waveform measurement point. These points are keyed on the circuit board detail.

NOTES

- 1. Unless otherwise indicated: Resistor values are in ohms; Capacitor values are in microfarads.
- 2. Only the protection circuit portion of the power amplifier is shown on this diagram. See the applicable separate power amplifier and harmonic filter schematic diagram for the complete circuit.
- 3. Points shown as 1, 2, etc. are connected to the interconnect board for distribution to other points in the radio.
- 4. J4801-J4805 installed as required to bus 2 or more channel select lines to a single channel element when those channels use the same receive frequency.
- 5. Frequency calculation: Fosc = Fc/12.
- 6. Frequency range sensitive part. Indicated value is for 146-174 MHz radios. See parts list for 136-146 MHz part values.
- 7. Circuitry shown in dashed box is used in 75 and 110 watt power amplifiers only.
- 8. E7, E8, E9 used in 75 and 110 watt radios only.
- 9. Used in HLD4001 only; (136-148 MHz).

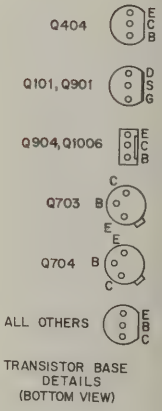
LEGEND

- Theory Note
- Maintenance Note
- Primary Signal Flow
- B - (Main Board Ref)
- Chassis Ref
- A - (PA Ref)



SQUARE PAD ON P.C. BOARD INDICATES

1. GATE OF FET
2. BASE OF TRANSISTOR
3. CATHODE OF DIODE
4. POSITIVE LEAD OF ELECTROLYTIC CAPACITORS

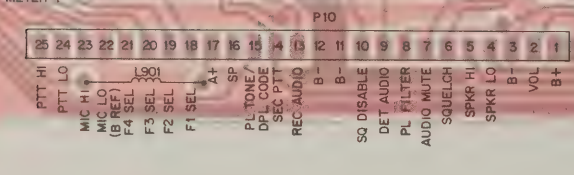


LEGEND

[Symbol] VOLTAGE OR WAVEFORM TEST POINT SEE SCHEMATIC DIAGRAM.

COMPONENT SIDE* BD-EEPS-29773-0
SOLDER SIDE * BD-EEPS-29774-0
OL-EEPS-27408-B
RV OL-EEPS-27412-0

* - CR403-4, R431, L401 OMITTED WHEN BUSY LIGHT OPTION USED.



OPTIONAL CONNECTIONS TO BUSY LIGHT ADAPTER BOARD

WHT - AUDIO MUTE

GRY - SQ. DISABLE

HIGH BAND MITREK RADIO

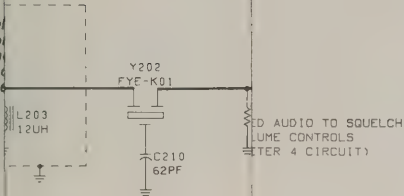
RECEIVER SECTION

NOTES:

- Unless otherwise specified:
Resistor values are in ohms
Capacitor values are in microfarads.
- Points shown ①, ②, etc. are connected to interconnect board (J10).
- Frequency calculation: $F_{osc} = \frac{F_c \cdot 10.7 \text{ MHz}}{3}$
- Function of interconnect board jumpers is as follows:
A. JU1 is only necessary when MITREK radios are used with negative ground MOCOM 70 accessories.
B. JU3 normally out — Clip may be installed in position A to connect an external PL tone or DPL code in encoder or may be installed at position O to provide an SP input to main board pin 16.
- Feedthru capacitors C11-C29 on interconnect board are all 470 pF.
- JU611 installed in single frequency radios to enable F1 channel elements. JU606-JU610 installed as required to bus 2 or more channel select lines to a single channel element when those channels use the same receiver frequency.
- JU101 is installed for non pre-amp radios. It is removed when optional pre-amp is installed.
- Frequency range sensitive part. Indicated value for (146-174 MHz) radios. See parts list for (136-146) MHz part values.
- JU460 out for "AND" squelch, in for "OR" squelch. When busy light option is used:
JU460 alone determines the type of squelch.
JU1 on PL board or JU5 on DPL board must be in.
JU2 on PL board or JU4 on DPL board must be out.
- CR403, CR404, R431, and L401 are omitted when busy light option is used and wires from Busy Light Adapter Board solder to holes normally occupied by these components.
- C30 is a part of Hardware Kit HLN4037A and is installed on back of INTERCONNECT BOARD see part no. 80 in Mechanical list for part number.

A channel is to connector. Each channel contains an output is three frequency.

9.5V



REC METERING
001

FROM DETECTOR (R222)
FROM AUDIO PREAMP (R234)

REC MTR 4
FROM Q4 COL

REC INJECTION (R104)

REC AUDIO

DET AUDIO ⑨

NOTE
L FLOW
(CONNECTS TO REF)

CONDITIONS

CONDITION	AUDIO MUTE ⑦	SQUELCH DISABLE ⑩	SQUELCH SWITCH EMITTER Q405	MUTE SWITCH COLLECTOR Q406
QUIET	6.8V	1.2V	1.2-3.5V	1.5-5.0V
PRESENT	6.8V	0.8V	0.0V	0.2V
QUIET	1.6V	0.4V	1.2-3.5V	1.5-5.0V
+ PL OR DPL	PL 7.6V DPL 12.3V	0.8V	0.0V	0.2V
W/O PL OR DPL	1.6V	0.4V	1.2-3.5V	1.5-5.0V
QUIET	1.6V	0.4V	1.2-3.5V	1.5-5.0V
+ PL OR DPL	1.6V	PL 8.1V DPL 13.6V	0.0V	0.2V
W/O PL OR DPL	1.6V	0.4V	1.2-3.5V	1.5-5.0V
QUYED	1.1V	0.3V	6.0V	3.5V
QUIET	TABLE B	TABLE B	1.2-3.5V	4.5V
PRESENT	TABLE B	TABLE B	0.0V	0.2V

CONDITIONS

	SQUELCH DISABLE ⑩	Q463 COLLECTOR	Q462 COLLECTOR	AUDIO MUTE ⑦
"OR" SQUELCH (PL OR DPL)	0V	1.4-2V**	9.4V	1.4-2V**
1. With microphone on-hook, pull squelch disable in regardless of noise input enables audio amplifier U401.	0V	5.9-8.8V**	9.4V	5.9-8.8V**
	0V	1.4-2V**	9.4V	1.4-2V**
2. With microphone off-hook allows circuit to operate in	0V	5.9-8.8V**	9.4V	5.9-8.8V**
	PL 8.1V DPL 13.6V	8.4V	0.1V	9.4V

TRANSMIT AUDIO MUTE

During transmit, audio m secondary PTT (on inter R412-R413 junction low p on. High at Q406 collector

Note 9 for proper installation of PL/DPL jumpers when Light Adapter HLN4119A is used.
ge depends on whether or not JU460 is in or out, and if is on or off hook.

EEPS-26056-C

68P81039E29-C
(Sheet 4 of 5)
8/1/82-TP

RECEIVER SECTION

HIGH BAND MITREK RADIO

RECEIVER SECTION BOARD DETAIL

parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2	23-83210A19	capacitor, fixed: 220 pF ± 5%; 500 V
C3	23-82783B25	4.7 uF ± 10%; 25 V
C11 thru 29	21-84674K01	470 pF ± 20%; 25 V (feed thru)
CR1	48-8225G19	diode, (see note)
CR2	48-83654H01	silicon
CR3	1-80701T78	silicon
CR4	48-8246B11	silicon
J1	1-80701T74	connector, receptacle:
J3	9-80180B02	connector, assembly; includes C11-C29
J10	9-80180B03	female, 3 contact
J13	9-80180B03	female, 25 contact
R2	6-124C55	resistor, fixed: 1.8k ± 10%; 1/4 W
R4	6-124C33	220 ± 10%; 1/4 W
mechanical parts		
	42-8008BA01	CLIP, option

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C480	23-84665F01	capacitor, fixed: 10 uF
L480		choke, 0.41 uH
R480	6-124A67	5.6k
R481	6-124A56	2k
R482	6-124A49	1k
R483	6-124A61	3.3k
R484	6-124A65	4.7k
R485	6-124A49	1k
R486	6-124A71	8.2k
R487	6-124A08	5.1k
R488	6-124A49	1k
R489	6-124A65	4.7k
R470	6-124A65	5.1k
R471	6-124A25	100
CR480 thru 482	48-83654H02	silicon
Q480	48-8906A2	transistor, (see note)
Q481	48-8906A3	NPN, type M9642
Q482	48-8906A4	PNP, type M9643
Q483	48-8906A3	PNP, type M9643

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

68P81039E29-C

(Sheet 3 of 5)

8/11/82-TP

PL-HLD4001A Main Board Receiver Section, RI (L = 136-146 MHz)

PL-HLD4002A Main Board Receiver Section, RI (H = 146-174 MHz)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	23-84665F04	capacitor, fixed: pF ± 5%; 500 V
C2	23-84665F01	1 uF ± 100-10%; 25 V
C3	23-84665G04	15 uF ± 20%; 20 V
C4	21-84403B41	100 ± 10%
C101	21-83596E10	220 ± 20%
C103	21-84493B41	100 ± 10%; 200 V
C104	21-84494B07	150
C105	21-80189A55	57, 200 V
C106	21-83406D90	11
C107	21-82610C03	47, 200 V
C108	23-845380C2	4.7 uF ± 20%; 20 V
C109	21-83596E36	.01 uF ± 60-40%; 250 V
C110	21-83596E10	220 ± 20%
C111	21-83596E10	220 ± 20%
C112H	21-80189A24	9.0 ± 5 pF
C112L	21-83406D93	12
C118	21-80189A24	9.0 ± 5 pF
C119	21-83406D93	12
C121	21-83596E10	220 ± 20%
C122	21-83596E10	220 ± 20%
C123	21-83596E10	220 ± 20%
C124	21-83596E10	220 ± 20%
C125	21-83596E10	220 ± 20%
C126	21-83596E10	220 ± 20%
C127	21-83596E10	220 ± 20%
C128	21-83596E10	220 ± 20%
C129	21-83596E10	220 ± 20%
C130	21-83596E10	220 ± 20%
C131	21-83596E10	220 ± 20%
C132	21-83596E10	220 ± 20%
C133	21-83596E10	220 ± 20%
C134	21-83596E10	220 ± 20%
C135	21-83596E10	220 ± 20%
C136	21-83596E10	220 ± 20%
C137	21-83596E10	220 ± 20%
C138	21-83596E10	220 ± 20%
C139	21-83596E10	220 ± 20%
C140H	21-830201	0.3; 500 V
C140L	21-842041	0.36
C141H	21-80067A12	4.25 uF ± 25 pF; 500 V
C141L	21-83406D94	6.8
C202	21-82372C10	.05 uF ± 20%; 25 V
C203	21-83406D96	24
C204	21-83406D96	24
C205, 206	21-82372C10	.05 uF ± 20%; 25 V
C207	21-83406D96	24
C208	21-83406D96	24
C209	21-83406D96	24
C210	21-80067A57	62; 200 V
C211	21-82450B04	0.3 ± 10%
C212	21-80189A55	57; 200 V
C213	21-80171A81	80 ± 10%; 250 V
C214	21-82372C10	.05 uF ± 20%; 25 V
C215	21-82372C10	.05 uF ± 20%; 25 V
C216	21-82372C10	.05 uF ± 20%; 25 V
C217	21-82372C10	.05 uF ± 20%; 25 V
C218	21-82372C10	.05 uF ± 20%; 25 V
C219	21-82372C10	.05 uF ± 20%; 25 V
C220	21-82372C10	.05 uF ± 20%; 25 V
C221	21-82372C10	.05 uF ± 20%; 25 V
C222	21-82372C10	.05 uF ± 20%; 25 V
C223	21-80171A81	80 ± 10%; 250 V
C224	21-82450B55	0.1 ± 10%
C225	21-83406D96	24
C226	21-83406D96	24
C227	21-82372C10	.05 uF ± 20%; 25 V
C228	21-83406D96	24
C229	21-82372C10	.05 uF ± 20%; 25 V
C230	21-82372C10	.05 uF ± 20%; 25 V
C231	21-83406D96	24
C232	21-82450B46	0.62
C233	21-83596E36	.0047 uF ± 10%; 100 V
C234	21-80189A55	57, 200 V
C235	21-83596E36	.0047 uF ± 10%; 100 V
C236	21-82372C10	.05 uF ± 20%; 25 V
C237	21-82372C10	.05 uF ± 20%; 25 V
C238	21-82372C10	.05 uF ± 20%; 25 V
C239	21-82372C10	.05 uF ± 20%; 25 V
C240	8-84637L30	.0022 uF ± 10%; 830 V
C412	8-84637L37	0.1 uF; 100 V
C413	8-84637L31	.047 uF ± 10%; 250 V
C414	21-84494B15	300
C415	23-845380G4	15 uF ± 20%; 20 V
C416	23-845380G4	15 uF ± 20%; 20 V
C417	23-845380G4	15 uF ± 20%; 20 V
C418	23-84665F01	10 uF ± 100-10%; 25 V
C419	8-84637L28	.018 uF ± 10%; 250 V
C420	8-84637L27	.022 uF ± 10%; 250 V
C421	8-84637L02	.033 uF; 250 V
C422	23-84665F01	10 uF ± 100-10%; 25 V
C423	8-84637L32	.0088 uF ± 10%; 100 V
C424	8-84637L24	.0088 uF ± 10%; 100 V
C425	8-84637L25	.01 uF ± 10%; 400 V
C426	8-84637L28	.0047 uF ± 10%; 100 V
C427	23-845380G4	15 uF ± 20%; 20 V
C431	23-84665F01	10 uF ± 100-10%; 25 V
C432	23-84665F06	220 uF ± 150-10%; 25 V
C433	8-84637L33	0.1 uF ± 10%; 100 V
C434, 436, 437	21-83596E10	220 ± 20%
C440	8-84637L27	.022 uF ± 10%; 25 V
C441, 450	23-84665F01	10 uF ± 100-10%; 25 V
C451	21-83596E10	220 ± 20%
C489	21-82187B44	.001 uF ± 10%; 100 V
CR1, 2	48-83654H01	silicon
CR101	48-83654H01	silicon
CR102	48-82139G01	germanium
CR401	48-83654H01	silicon
CR403 thru 406	48-83654H01	silicon
CR408 thru 612	48-83654H01	silicon
connector, receptacle:		
		female, 12 contact
J1001	9-82748G01	

PL-HLD4001A Main Board Receiver Section, RI (L = 136-146 MHz)

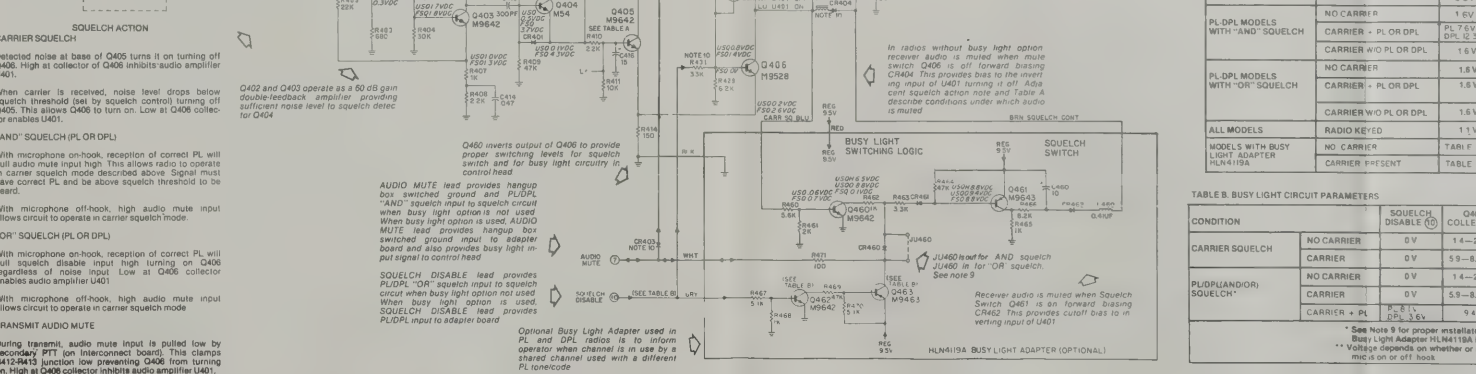
PL-HLD4002A Main Board Receiver Section, RI (H = 146-174 MHz)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L1H	24-80032A02	coll:
L1L	24-80032A07	helical; (coded RED)
L2H	24-80032A03	helical; (coded ORG)
L2L	24-80032A08	helical; (coded BR)
L3H	24-80032A05	helical; (coded NAT)
L3L	24-80032A09	helical; (coded GR)
L405	24-80032A01	helical; (coded NAT)
L4L	24-80032A06	helical; (coded BLU)
L5H	24-80032A04	helical; (coded YEL)
L5L	24-80032A10	helical; (coded BLU)
L10	76-3960B07	1/2 turn ferrite
L106	24-80034A03	3 1/2 turns; (coded RED)
L107	24-84419D01	17 1/2 turns; (coded WHT)
L108	24-82835G28	choke, 15 uH
L109	24-80065A03	4 1/2 turns; (coded YEL)
L111	24-80065A01	4 1/2 turns; (coded RED)
L112, 113	24-82549D29	choke, 1.8 uH
L114	24-80065A01	4 1/2 turns; (coded RED)
L115	24-82549D29	choke, 1.8 uH
L140, 141	24-82723H04	choke, 0.29 uH
L201	24-82549D51	choke, 10 uH
L202	24-82549D52	choke, 12 uH
L204	24-84419D03	33 1/2 turns; (coded GRN)
L206	24-84419D03	33 1/2 turns; (coded GRN)
L207	24-82549D52	choke, 12 uH
L208	24-80133A01	26 1/2 turns
L209	24-82835G20	choke, 9.3 uH
L401	24-82723H05	choke, 0.41 uH
P4	28-80181B04	connector, plug:
P10	28-80181B03	male, 2 contact
P11	28-80097A01	male, 25 contact
P12	28-80181B01	male, 5 contact
P605 thru 608	28-80096A01	male, 4 contact
transistor, (see note)		
Q1, 2, 3	48-8906A3	PNP, type M9643
Q4	48-8906A2	NPN, type M9642
Q101	48-8906A3	PNP, type M9643
Q102	48-8906A2	NPN, type M9642
Q201 thru 203	48-8906A4	NPN, type M9644
Q401 thru 403	48-8906A2	NPN, type M9642
Q404	48-8906A3	PNP, type M9643
Q405	48-8906A2	NPN, type M9642
Q406	48-8906A3	PNP, type M9643
resistor, fixed: ± 10%; 1/4 W;		
		unless otherwise stated
R1	6-124C59	2.7k
R2	6-124C91	56k
R3	6-124A53	1.8k ± 5%
R4	6-124A65	4.7k ± 5%
R5	6-124C77	15k
R6	6-124A81	22k ± 5%
R7	6-124C15	39 ± 5%
R8	6-124C73	10k
R9	6-124C96	21 uF ± 10%; 114 V
R10	6-124C83	27k
R11	6-124A41	470 ± 5%
R12	6-80272D01	15k
R13	6-124C93	68k
R14	6-124C65	4.7k
R101	6-124C25	330 ± 5%
R102	6-124A37	100 ± 5%
R103	6-124A25	100 ± 5%
R104	6-124A81	3.3k ± 5%
R105	6-124A24	91 ± 5%
R106	6-124A45	680 ± 5%
R107	6-124A57	2.2k ± 5%
R110	6-124A59	2.7k ± 5%
R111	6-124A97	100k ± 5%
R112	6-124D55	2.7
R113	6-124C25	15
R201	6-124A49	1k ± 5%
R202	6-124A79	18k ± 5%
R203	6-124A87	38k ± 5%
R204	6-124A37	330 ± 5%
R205	6-124A09	22 ± 5%
R206	6-124A59	2.7k ± 5%
R207	6-124A83	27k ± 5%
R208	6-124A45	680 ± 5%
R209	6-124C23	2.7k ± 5%
R210	6-124A69	6.8k ± 5%
R211	6-124A83	27k ± 5%
R212	6-124A71	820 ± 5%
R213	6-124A61	3.3k ± 5%
R214	6-124A83	27k ± 5%
R215	6-124A69	6.8k ± 5%
R216	6-124A47	820 ± 5%
R217	6-124A61	3.3k ± 5%
R218	6-124A79	18k ± 5%
R219	6-124A56	2k ± 5%
R220	6-124C95	82k
R221	6-124A83	27k ± 5%
R222	6-124C85	4.7k
R223	6-124C95	1k
R224	6-124A70	7.5k ± 5%
R230	6-124A70	7.5k ± 5%
R231	6-124A70	7.5k ± 5%

PL-HLD4001A Main Board Receiver Section, RI (L = 136-146 MHz)

PL-HLD4002A Main Board Receiver Section, RI (H = 146-174 MHz)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R232	6-124A21	68 ± 5%
R233	6-124C13	33
R234	6-124B06	220k ± 5%
R401	6-124A84	75k ± 5%
R402	6-124A80	6.8k ± 5%
R403	6-124A45	680 ± 5%
R404	6-124A84	30k ± 5%
R405	6-124A81	22k ± 5%
R406	6-124A73	10k ± 5%
R407	6-124A49	1k ± 5%
R408	6-124A57	2.2k ± 5%
R409	6-124C80	47k
R410	6-124C57	2.2k
R411	6-124A75	10k ± 5%
R412	6-124A72	9.1k ± 5%
R413	6-124A79	18k ± 5%
R414	6-124C29	150
R415	6-124C73	10k
R416	6-124A73	10k ± 5%
R417	6-124A97	100k ± 5%
R418	6-124C73	10k
R419	6-124A87	3.3k
R420, 421	6-124A87	5.8k ± 5%
R422	6-124A40	450 ± 5%
R423	6-124A08	22 ± 5%
R424	6-124A03	12 ± 5%
R425	6-124A45	680 ± 5%
R426, 427	6-124D55	2.7
R428	6-124A82	24k ± 5%
R429	6-124A68	8.2k ± 5%
R430	6-124A71	8.2k ± 5%
R431	6-124C85	33k
R440	6-124C49	1k
R442	6-124C93	88k
R450	6-124C73	10k
R451	6-124A67	5.8k ± 5%
R452	6-124C81	3.3k
R453	6-124B02	150k ± 5%
R454	6-124C67	5.8k
RT401	6-83800K08	thermistor: 20k ± 10%; @ 25°C
integrated circuit: (see note)		
U201	51-84320A78	type M2078
U401, 402	51-84621K06	type M2160
U403	51-84621K78	type M2176
crystal:		
Y201	48-84396K05	10.7 MHz
Y202	48-84396K01	10.7 MHz
Y203	48-84396K03	10.



RECEIVER SECTION

1. Unless otherwise specified
Resistor values are in ohms
Capacitor values are in microfarads
2. Points shown ①, ② etc are connected
interconnect board (J10).
3. Frequency calculation $F_{osc} = F_c \cdot 10.7 \text{ MHz}$

A JU1 is only necessary when MITREK radios are

B JU3 normally out — Clip may be installed in

to provide an SP input to main board pin 16

9. J611 installed in place of other frequency alarm: J611

nel element when those channels use the same receiver frequency.

when optional pre-amp is installed

part values

JU460 alone determines the type of squeal

ponents

TABLE 8. BUSY LIGHT CIRCUIT PARAMETERS					
CONDITION		QUELCH DISEL ¹ (2)	Q453 COLLECTOR	Q452 COLLECTOR	AUDI- MUTE ³
CARRIER QUELCH	NO CARRIER	0 V	1.4-2 V**	8.4 V	4-2 V**
	CARRIER	0 V	5.9-8.8 V**	9.4 V	5.9-8.8 V**
UDPL(AND/OR) QUELCH ⁴	NO CARRIER	0 V	1.4-2 V**	9.4 V	1.4-2 V**
	CARRIER	0 V	5.9-8.8 V**	9.4 V	5.9-8.8 V**
	CARRIER + PL	P = 1 W RF ₁ = 3.5 V	9.4 V	9.4 V	2.8 V

* See Note 9 for proper installation of PLUDL in pairs when Busy Light Adapter (HL) is not used.

** Voltage depends on whether or not 2J460 is in or out, and if in is on or off line.

* See Note 9 for proper installation of PL/DPL jumpers when Busy Light Adapter HLH4119A is used.

parts list

legend D4021B (136-146 MHz) AND H

L = 136-146 MHz
H = 146-174 MHz

HLD4021B Power Amp
HLD4022A Power Amp

REFERENCE
SYMBOL

C801	21-
C802L	21-
C802H	21-
C803L, 804L	21-
C803H, 804H	21-
C807	8-8
C808L	21-
C808H	21-
C810L	21-
C810H	21-
C811H	20-
C812L, 813L	21-
C812H, 813H	21-
C817L	21-
C817H	21-
C818L	21-
C818H	21-
C821H	21-
C822	21-
C823H	20-
C825L	21-
C825H	21-
C826L	21-
C826H	21-
C827L, C828L	21-
C827H, C828H	21-
C829L	21-
C829H	21-
C830L	21-
C830H	21-
C831, 832	21-
C833L, 834L	21-
C833H, 834H	21-
C835	23-
C836	21-
C837L	21-
C837H	21-
C838	21-
C839	23-
C840L	21-
C840H	21-
C845L	21-
C846L	21-
C847L	20-
C848L	21-
C850L	21-
C891	21-

CR801 4-

L801	21-
L803	21-
L804	21-
L805	21-
L806	21-
L807L	21-
L807H	21-
L808L	21-
L808H	21-
L809L	21-
L809H	21-
L810L	21-
L810H	21-
L811L	21-
L811H	21-
L812	21-
L813	21-
L814	21-

R801	6-
R802	6-
R803	6-
R804	6-
R806	6-
R811L	6-
R811H	6-
R812L	6-
R812H	6-
R813L	6-
R813H	6-
R814	6-
R815, 816	6-
R818	6-

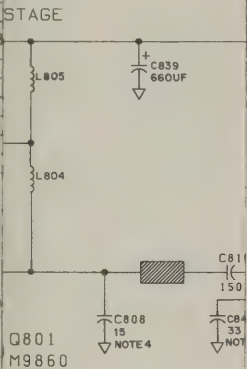
RT801

E802, 803

JU801H
JU802H

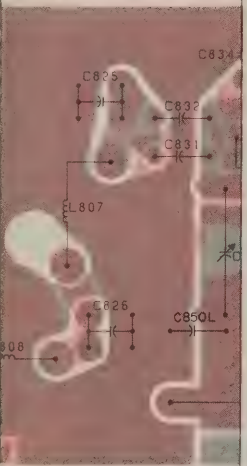
60 W MITREK POWER AMPLIFIER

MODELS HLD1011A (136-146 MHz)
AND HLD1012A (146-174 MHz)



FUNCTION

Increases power output of radio to 60 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.



COMPONENT SIDE

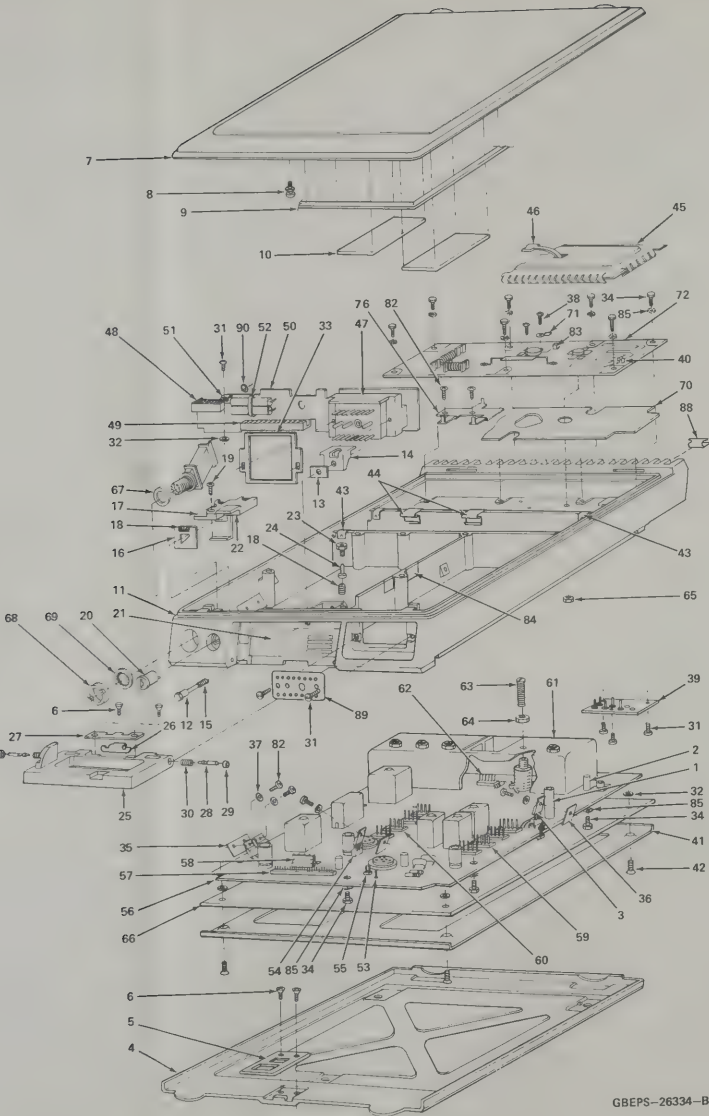
POWER AMPLIFIERS

68P81039E32-D
8/1/82-TP

HIGH BAND MITREK RADIO

MECHANICAL PARTS

68P81039E29-C
(Sheet 5 of 5)
8/1 /82-TP

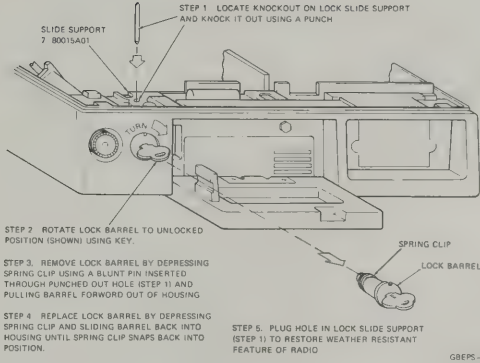


parts list

Mechanical Parts List for High Band MITREK Radio			PL-6053-D
ITEM	MOTOROLA PART NO.	DESCRIPTION	
1	26-80150B01	HEATSINK	
2	42-80259A01	CLIP, coax termination	
3	—	OR: Q1006, SEE ELECTRICAL PARTS LIST	
4	15-84677L01	COVER, bottom	
5	64-80017A01	PLATE, latch	
6	3-10906A05	SCREW, machine (M3.5 x 0.6 x 8) 4 used	
7	15-84678L01	COVER, top (40 & 60 W models)	
8	or 50-80135A01	COVER, top (75 & 110 W models)	
9	46-80026A01	STUD, latch	
10	32-80075A01	GASKET, top cover (40 & 60 W models)	
11	or 32-80276A01	GASKET, top cover (75 & 110 W models)	
12	75-80243B01	PAD, compression; 2 used	
13	15-84676L01	HOUSING (40 & 60 W models)	
14	or 15-80135A01	HOUSING (75 & 110 W models)	
15	47-80027A01	PUSHBUTTON	
16	32-80148C01	GASKET, pushbutton	
17	7-80030A01	BRACKET, latch	
18	41-80029A01	SPRING, latch	
19	7-80018A01	BRACKET, lock slide	
20	7-80015A01	SUPPORT, lock slide	
21	41-80022A01	SPRING, lock; 2 used	
22	3-10936B15	SCREW, tapping (B3.5 x 1.27 x 13)	
23	55-80370A01	LOCK	
24	13-80063A01	ESCUTCHEON	
25	32-80081A01	GASKET, lock support	
26	43-80150A01	SLEEVE, cover release	
27	46-80151A01	STUD, cover release	
28	55-80002A01	HANDLE	
29	7-800113B01	BRACKET, latch	
30	64-80019A01	PLATE, backup	
31	47-80021A01	PIN, pivot; 2 used	
32	4-80125A01	WASHER, pivot; 2 used	
33	41-80175A01	SPRING, (3.05 MM O.D.) 2 used	
34	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6) 6 used	
35	4-80149A01	WASHER, captive; 5 used	
36	32-80074A01	GASKET, cable plug	
37	3-10936A06	SCREW, tapping (B3.5 x 1.27 x 8) 33 used (40 & 60 W models)	
38	or 3-10936A06	SCREW, tapping (B3.5 x 1.27 x 8) 32 used (75 & 110 W models)	
39	14-80090A01	INSULATOR, mica	
40	14-84381F01	INSULATOR, Mica; 2 used	
41	4-84180C01	WASHER, shoulder; 4 used	
42	3-10905A05	SCREW, machine (M3 x 0.5 x 8); 2 used on 40 & 60 W models, 4 used on 75 & 110 W models	
43	64-80005A01	PLATE, feed-thru	
44	29-80014A01	CLIP, coax terminal (40 & 60 W models)	
45	or 29-80014A01	CLIP, coax terminal; 2 used (75 & 110 W models)	
46	15-80004A01	COVER, bottom inner	
47	3-10906A19	SCREW, machine (M3.5 x 0.6 x 13) 4 used	
48	42-80013A01	CLIP, coax (dress); 3 used	
49	42-80039A01	CLIP, coax; 2 used	
50	26-80211A01	SHIELD, PA (40 & 60 W models)	
51	or 26-80070B02	SHIELD, PA (75 & 110 W models)	
52	55-84300B04	HANDLE, nylon	
53	—	J1: SEE ELECTRICAL PARTS LIST	
54	—	J3: SEE ELECTRICAL PARTS LIST	
55	—	J2: SEE ELECTRICAL PARTS LIST	
56	—	CIRCUIT BOARD, interconnect	
57	7-80079A01	BRACKET, IC bd. support	
58	42-10217A26	STRAP, cable harness; 2 used	
59	29-10274A15	PIN, terminal; 8 used	
60	—	J901, 1003; SEE ELECTRICAL PARTS LIST	
61	—	P1004; SEE ELECTRICAL PARTS LIST	
62	—	CIRCUIT BOARD	
63	—	P10: SEE ELECTRICAL PARTS LIST	
64	—	P11: SEE ELECTRICAL PARTS LIST	
65	—	P601 thru P604, SEE ELECTRICAL PARTS LIST	
66	—	P605 thru P608; SEE ELECTRICAL PARTS LIST	
67	15-80008A01	HOUSING pre-selector	
68	3-80012A04	P112: SEE ELECTRICAL PARTS LIST	
69	2-80045A01	SCREW, set (M5 x 17.00); 5 used	
70	2-7003	NUT, retainer (M5 x 1) 5 used	
71	—	NUT, 8-32 x 5/16 x 1/8" hex; 2 used (75 & 110 W models)	
72	32-80076A01	GASKET, bottom inner, (COV)	
73	32-80080A01	GASKET, antenna connector	
74	2-80006A01	NUT, spanner	
75	4-114522	WASHER, lock	
76	14-80077A01	INSULATOR, PA compartment (40 & 60 W models)	
77	or 40-80143A02	INSULATOR, PA compartment (75 & 110 W models)	
78	7-80078A01	BRACKET, thermistor mounting	
79	—	CIRCUIT BOARD	
80	7-80291A01	BRACKET, ground (40 & 60 W models)	
81	26-80052B01	SHIELD, FILTER (75 & 110 W models)	

GBEPS-26334-B

LOCK REMOVAL PROCEDURE



GBEPS-27561-D

MITREK RADIO GASKET KITS

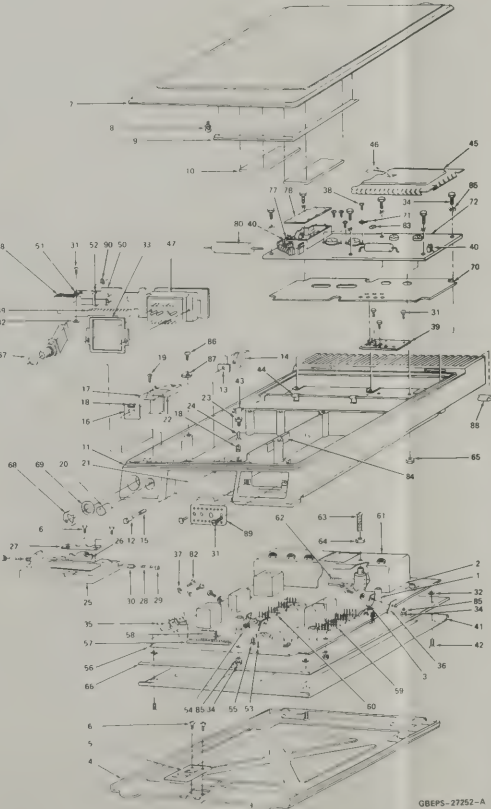
To ensure the continued weather resistance of the MITREK radio the gaskets must be maintained when servicing the radio and control head. The following are the gasket kits required for radio connector, lock, and control head servicing:

Front and Antenna Connector Gasket Kit (Kit No. RPX4128A)			
Description	Qty. Supplied	Part Number	
Front Connector, External	10	32-80020C01	
Front Connector, Internal	10	32-80074A01	
Antenna Connector	10	32-80080A01	

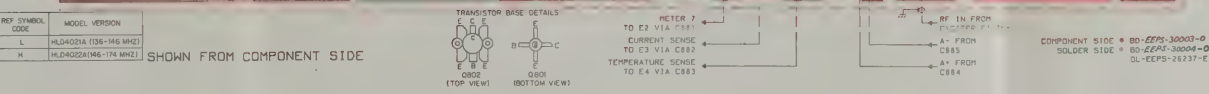
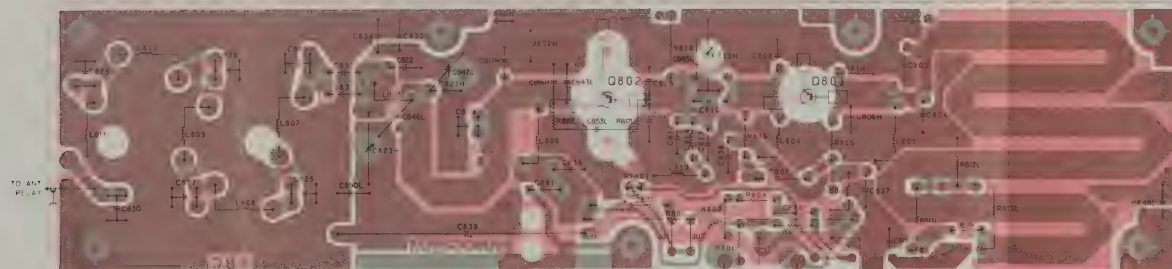
Lock Gasket Kit (Kit No. RPX4130A)		
Description	Qty. Supplied	Part Number
Lock Support Gasket	10	32-80081A01
Lock Support Slide	10	7-80015A01
Push Button	10	32-80148C01

Control Head Gasket Kit (Kit No. RPX4129A)		
Description	Qty. Supplied	Part Number
Top Housing	10	32-80203B01
Rear Connector	10	32-80038C01
Control Shaft "O" Ring	10	42-10128A23
Pushbutton "O" Ring	10	42-10128A22

GBEPS-27252-A



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
mechanical parts		
E802,803	29-80014A01 42-10217A26	CLIP, coax (terminal) TIE STRAP, for C839
JU801H JU802H		JUMPER WIRE JUMPER WIRE
PL-5963		
HLN4A021A PA Feed-Thru Plate		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C881 thru B85	21-62812H03	capacitor, fixed: 100 pF ± 100.4%; 500 V
mechanical parts		
	64-80005A01 6-83755H01	PLATE, feed-thru WASHER, solder
PL-6324		
HLDA063A Power Transistor Kit (40/60 W, High Band)		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q801 Q802	48-869860 48-84411L04	transistor: (see note) NPN; type M9860 NPN; type M1104
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.		
HLN4A090A Power Amplifier Hardware Kit (60 W) 136-148 MHz		
PL-6325		
HLN4A003A Power Amplifier Hardware Kit (60 W) 146-174 MHz		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C808H C814, B15 C943L C818H	21-84366F12 21-84366F12 21-84366F22 21-82880E34	capacitor, fixed: 200 pF ± 10%; 500 V (146-174 MHz only) 200 pF ± 10%; 500 V 50 pF ± 5%; 250 V 250 pF ± 10%; 500 V
R817L, R819L	6-125A-09	resistor, fixed: 22 ± 5%; 1/2 W
mechanical parts		
	2-7003 3-10906A01 3-10906A05 3-10936A06 4-7366 7-80078A01 7-800291A01 14-60077A01	NUT, 8-32 x 5/16 x 1/8" for Q801 SCREW, machine (M3 x 0.5 x 8) for harm. fil. grid brkt. SCREW, machine (M3 x 0.5 x 8) for Q802; 2 used SCREW, tapping (B3.5 x 1.27 x 8); 7 used WASHER, lock; 7 used BRACKET, (thermistor mount) GROUND BRACKET, harmonic filter INSULATOR, PA compartment
antenna switch parts		
	2-80006A01 4-114522 32-80090A01	NUT, spanner WASHER, lock 5/8 Int. GASKET
feed thru plate		
	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6); 3 used



Increases power output of radio to 60 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

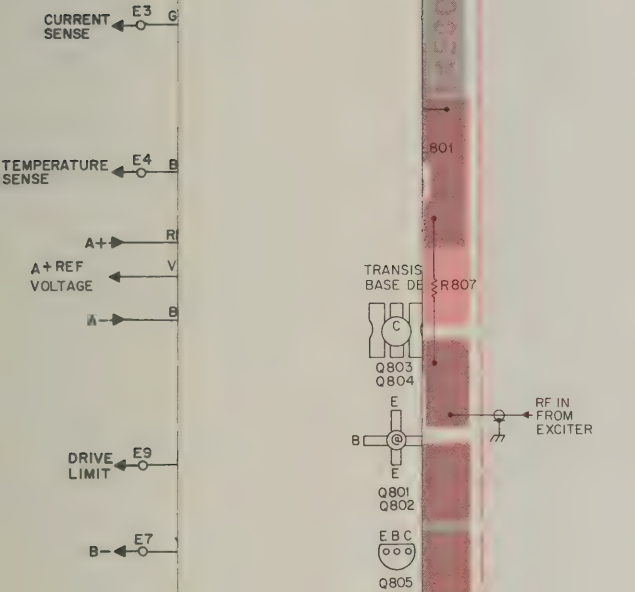
z)
z) PL-5981-E

DESCRIPTION
capacitor, fixed: $\mu\text{F} \pm 10\%$; unless otherwise stated 1 + 60-40%; 200 V 1 pF $\pm 5\%$; 200 V 5 pF $\pm 5\%$; 200 V 7 pF $\pm 5\%$; 200 V; N150 5 pF $\pm 5\%$; 200 V 7 pF $\pm 5\%$ 7 pF $\pm 5\%$; 200 V 68 $\mu\text{F} \pm 5\%$; 50 V 4 pF $\pm 5\%$; 500 V 0 pF $\pm 5\%$; 500 V 50 pF $\pm 5\%$ 50 pF; 500 V 2 pF $\pm 5\%$ NOT USED 7 pF $\pm 5\%$; 200 V NOT USED 6 pF $\pm 5\%$; 500 V 60 pF $\pm 2\%$ 0 pF $\pm 5\%$; 250 V NOT USED 3 pF $\pm 5\%$; 500 V NOT USED 6 pF $\pm 5\%$; 500 V 6 pF $\pm 5\%$; 500 V 0 pF ± 0.5 pF 4 pF $\pm 5\%$; 500 V 6.5 pF $\pm 5\%$ 5 pF $\pm 5\%$; 850 V 8 pF ± 5 6 pF $\pm 5\%$; 850 V 6 pF $\pm 5\%$ 4 pF $\pm 5\%$; 850 V 8 pF $\pm 5\%$ 6 pF $\pm 5\%$; 850 V 6.5 pF $\pm 5\%$ 5 pF $\pm 5\%$; 850 V 50 pF; 500 V NOT USED 50 pF; 500 V NOT USED 50 pF; 500 V 0; 25 V 01 + 60-40%; 200 V 60 + 150-10%; 25 V 50 pF $\pm 5\%$ 001; 1000 V 50 pF $\pm 5\%$ 33 pF $\pm 5\%$ NOT USED 15 pF $\pm 5\%$ variable; 7-57 pF NOT USED 50 pF $\pm 5\%$ 00022 $\pm 20\%$; 500 V 50 pF; 500 V diode: silicon coil: ferrite; 1/2 turn NOT USED ferrite; 2-1/2 turns 1-1/2 turns 4-1/2 turns; molded 5-1/2 turns; molded 14-1/2 turns; molded 2-1/2 turns 6-1/2 turns 6-1/2 turns 5-1/2 turns 5-1/2 turns 6-1/2 turns 6-1/2 turns 290 nH ferrite; 1/2 turn NOT USED 290 nH NOT USED

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R801L	17-80233B01	resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated
R801H	17-80233B02	.02; 5 W
R802, 803H, 804	6-124A49	.03; 5 W
R803L	6-124A45	1k
R806	6-124C33	680
R811L	6-125A01	220 $\pm 10\%$
R811H	6-125B64	10; 1/2 W
R812L	6-125A24	6.2; 1/2 W
R812H	6-125A32	91; 1/2 W
R813L	6-125A01	200; 1/2 W
R813H	6-125B64	10; 1/2 W
R814	6-124A01	6.2; 1/2 W
R815L, R816L	6-125A11	10
R815H, 816H	6-124A25	27; 1/2 W
R818L	6-125C01	100
R818H	6-125A11	10 $\pm 10\%$; 1/2 W
		27; 1/2 W
RT801	6-83600K09	thermistor: 100k @ 25 °C
mechanical parts		
E802, 803	29-80014A01	CLIP, coax (terminal)
	42-10217A26	TIE STRAP, for C839
HLN4021A PA Feed-Thru Plate		PL-5983-C
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C881 thru 885	21-82812H03	capacitor, fixed: 1000 pF + 100-0%; 500 V
mechanical parts		
	64-80005A01	PLATE, feed-thru
	4-83755H01	WASHER, solder
HLD4063A Power Transistor Kit 40/60 W High Band		
HLD4061A Power Transistor Kit (40 W; 146-174 MHz)		PL-6326-A
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q801	48-869860	transistor: (see note) NPN; type M9860
Q802H	48-84411L03	NPN; type M1103
Q802L	48-84411L04	NPN; type M1104
note: For optimum performance, diode, transistors, and integrated circuits must be ordered by Motorola part numbers.		
HLN4079A Power Amplifier Hardware Kit (136-146 MHz)		
HLN4002A Power Amplifier Hardware Kit (146-174 MHz)		PL-6327-D
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C814, 815, 806H	21-84366F12	capacitor, fixed: 200 pF $\pm 10\%$; 500 V
C843L	21-84366F22	50 pF $\pm 5\%$; 250 V
C841L	21-84366F12	200 pF $\pm 10\%$; 500 V
C842H	21-84366F22	50 pF $\pm 5\%$; 250 V
C843H	21-84366F08	40 pF $\pm 5\%$; 250 V
mechanical parts		
	2-7003	NUT, 8-32 x 5/16 x 1/8" for Q801
	3-10905A01	SCREW, machine (M3 x 0.5 x 6) for harm. filt. gnd. brkt.
	3-10905A05	SCREW, machine (M3 x 0.5 x 8) for Q802; 2 used
	3-10936A06	SCREW, tapping (B3.5 x 1.27 x 8); 7 used
	4-7666	WASHER, lock; 7 used
	7-80078A01	BRACKET, thermistor mount
	7-80291A01	GROUND BRACKET, harmonic filter
	14-80077A01	INSULATOR, PA compartment
antenna switch mounting parts		
	2-80006A01	NUT, spanner
	4-114522	WASHER, lock, 5/8 int.
	32-80080A01	GASKET
feed thru plate		
	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6); 3 used

POWER AMPLIFIER

75 or 110 WATT, 146-174 MHz
MODEL HLD1032A

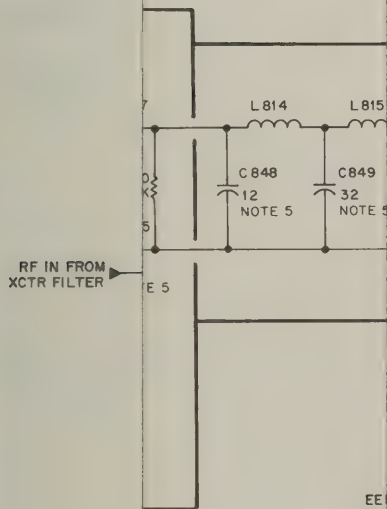


FUNCTION

Increases power output of radio to 75 or 110 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

NT SIDE
ER SIDE

BD-EEPS-26804-A
BD-EEPS-26805-A
OL-EEPS-26806-A



PARTS LIST SHOWN ON BACK

68P81040E53-A

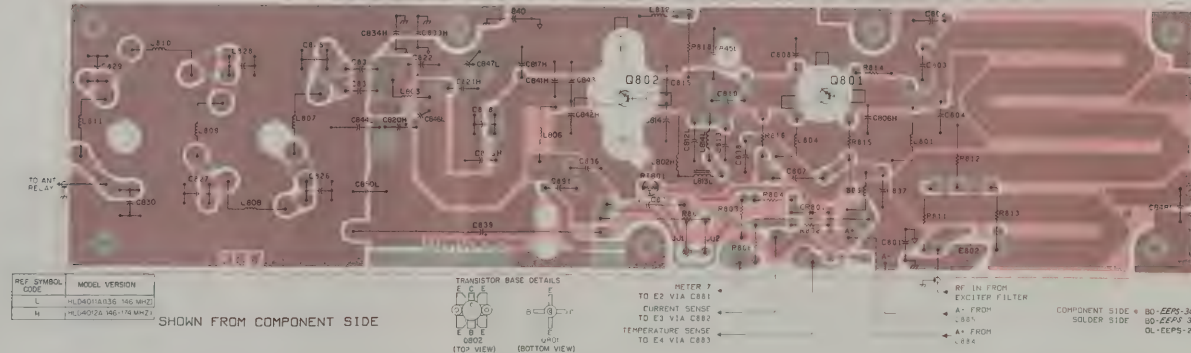
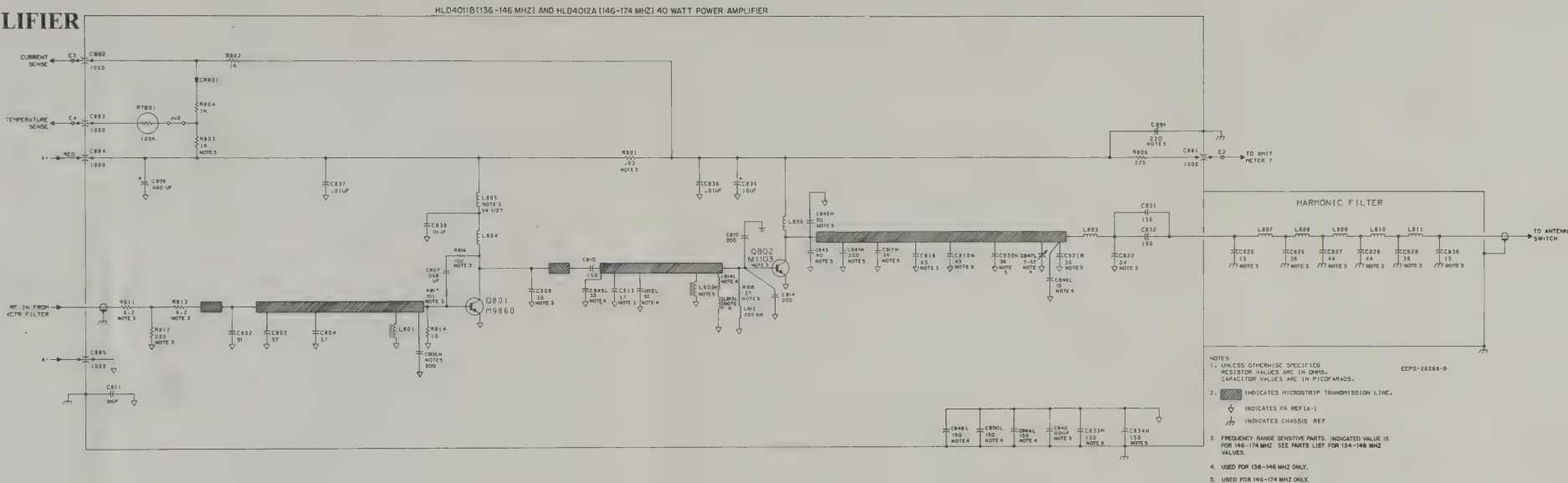
8/1/82-TP

POWER AMPLIFIER

MODELS HLD1001A (136-146 MHz)
AND HLD1002A (146-174 MHz)

Increases power output of radio to 40 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.

The power level can be adjusted from 30-40 watts on the 136-146 MHz models.



Legend:

HLD4012A Power

HL4011B Power Amplifier (136-15 MHz)			PL-5981 E
HL4012A Power Amplifier (146-174 MHz)			
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
		capacitor, fixed: up to 10%; unless otherwise stated	
C901	21 83596936	01 - 60 400 V, 200 V	
C902L	21 84408017	5 pF ± 5%, 500 V	
C903	21 83406092	36 pF ± 5%, 200 V	
C903L	21 80168A55	57 pF ± 5%, 200 V, N150	
C903H	21 83406092	36 pF ± 5%, 200 V	
C904L	21 80168A55	57 pF ± 5%	
C904H	21 80168A55	57 pF ± 5%, 200 V	
C907	834311H23	068 pF ± 5%, 50 V	
C908L	21 83406092	24 pF ± 5%, 500 V	
C908H	21 80171A45	30 pF ± 5%, 500 V	
C910L	21 84403854	150 pF ± 5%	
C910H	21 83137400	150 pF ± 5%	
C912L, C913L	21 84403830	62 pF ± 5%	
C912H		NOT USED	
C913H	21 80169A55	57 pF ± 5%, 200 V	
C917L		NOT USED	
C917H	21 83406092	36 pF ± 5%, 500 V	
C918L	21 84396916	100 pF ± 2%	
C918H	21 84396907	60 pF ± 5%, 500 V	
C919L		NOT USED	
C919H	21 83406087	43 pF ± 5%, 500 V	
C920L		NOT USED	
C920H	21 83406092	36 pF ± 5%, 500 V	
C921H	21 83406092	36 pF ± 5%, 500 V	
C922L	21 83406092	10 pF ± 0.5 pF	
C922H	21 83406092	24 pF ± 5%, 500 V	
C925L	21 84395946	16 pF ± 5%	
C925H	21 84395916	15 pF ± 5%, 850 V	
C926L	21 84395943	38 pF ± 5%	
C926H	21 84395917	36 pF ± 5%, 850 V	
C927L, 8281L	21 84395944	46 pF ± 5%	
C927H, 8281H	21 84395915	44 pF ± 5%, 850 V	
C929L	21 84395943	38 pF ± 5%	
C929H	21 84395917	36 pF ± 5%, 850 V	
C930L	21 84395916	16 pF ± 5%	
C930H	21 84395916	15 pF ± 5%, 850 V	
C931, 832, C933L	21 82187849	150 pF, 500 V	
C933H		NOT USED	
C934L	21 82187849	150 pF, 500 V	
C934H		NOT USED	
C935	21 82187849	150 pF, 500 V	
C936, 837, 838	23 82783827	10, 25 pF	
C937	21 83596136	01 - 60 400 V, 200 V	
C938	831210A22	860 - 150 100 V, 25 V	
C940L	21 82204B54	100, 1000 V	
C940H	21 82204B54	150 pF ± 5%	
C944L	21 82204B54	33 pF ± 5%	
C945L	21 83406071	NOT USED	
C945H		NOT USED	
C946L	21 83406097	15 pF ± 5%	
C947L	20 64579B11	variable, 1.5 to 57 pF	
C947H		NOT USED	
C948L, 850L	21 82204B54	150 pF ± 5%	
C991H	21 83596110	00022 ± 20%, 500 V	
C991L	21 82187849	150 pF, 500 V	
		diodo:	
		silicon	
CR801	48 82466H13		
		coil:	
L801	24 90036A02	ferrite, 1/2 turn	
L802L		NOT USED	
L812H	24 83977B02	ferrite, 2 1/2 turns	
L803	24 84617A05	1 1/2 turns	
L804	24 83884C06	4 1/2 turns; molded	
L805L	24 83884C08	5 1/2 turns; molded	
L805H	24 84611B02	14 1/2 turns; molded	
L806	24 83847C10	2 1/2 turns	
L807, 808L	24 90066A03	6 1/2 turns	
L807H, 808H	24 90066A01	6 1/2 turns	
L809L	24 90066A04	5 1/2 turns	
L809H	24 90066A02	6 1/2 turns	
L810L, L811L	24 90066A03	5 1/2 turns	
L810H, L811H	24 90066A01	6 1/2 turns	
L812	24 82723H04	290 nH	
L813L	24 90036A02	ferrite, 1/2 turn	
L813H		NOT USED	
L814L	24 82723H04	290 nH	
L814H		NOT USED	

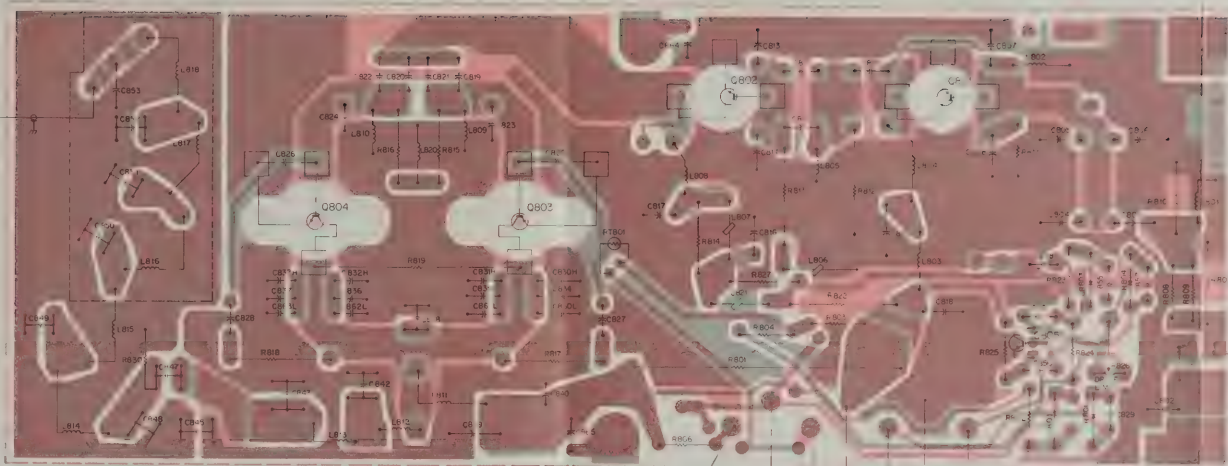
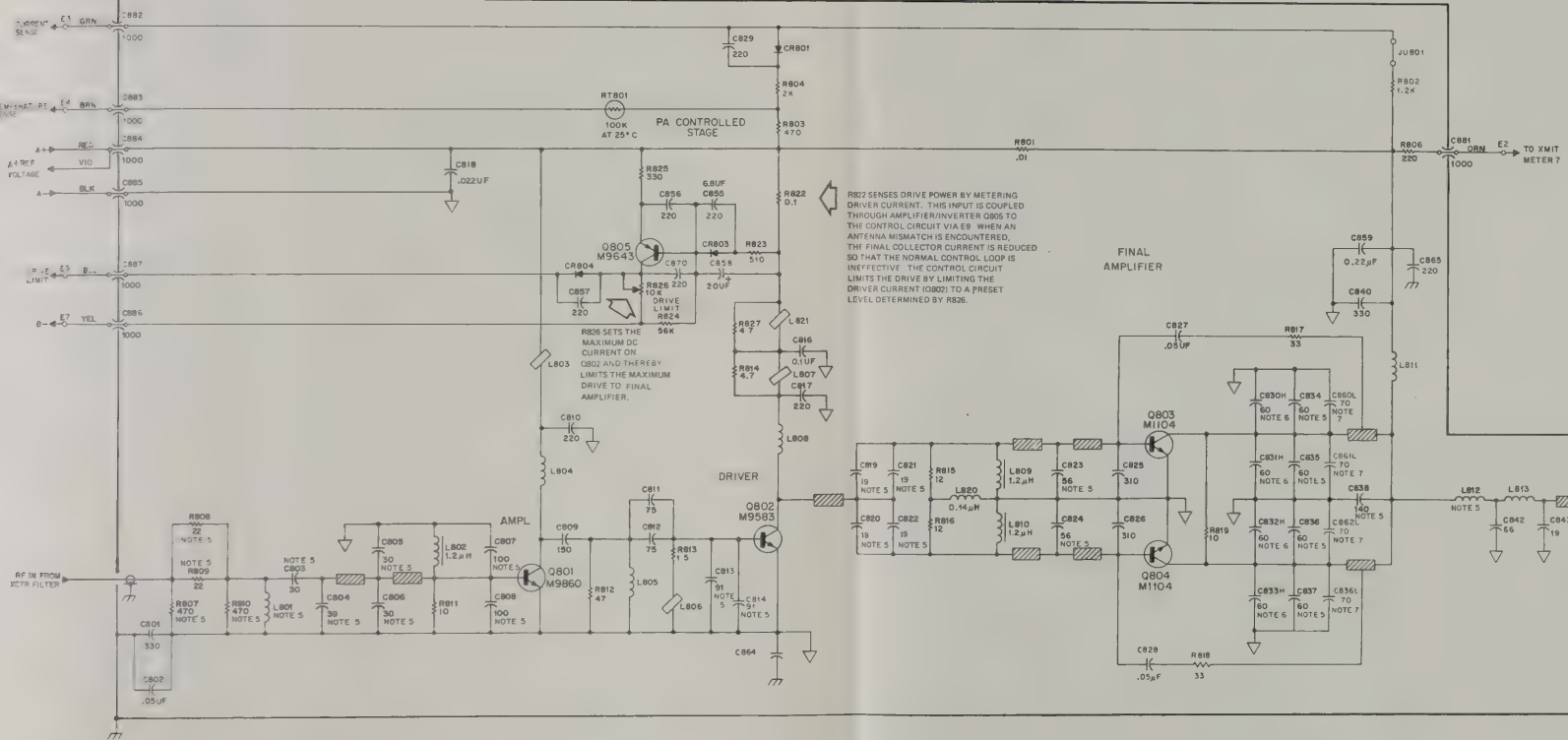
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated
R801L	17-80233B01	22, 5 W
R801H	17-80233B02	33, 5 W
R802, 803H, 804	6-124A49	1k
R802L	6-124A45	680
R806	6-124C33	220 $\pm 10\%$
R811L	6-125A01	10, 1/2 W
R811H	6-125B84	6.2, 1/2 W
R812L	6-125A24	91, 1/2 W
R812H	6-125A32	200, 1/2 W
R813L	6-125A01	10, 1/2 W
R813H	6-125B84	6.2, 1/2 W
R814	6-124A01	10
R815L, R816L	6-125A11	27, 1/2 W
R815H, R816H	6-124A25	100
R818L	6-125C01	10 $\pm 10\%$; 1/2 W
R818H	6-125A11	27, 1/2 W
		thermistor
RT901	6-5360K09	100 Ω $\pm 25^\circ\text{C}$
		mechanical parts
E807, 803	29-8001A401	CLIP, coax (terminal)
	42-10217A26	THE STRAP, for C839
HLN4021A PA Feed-Thru Plate		PL 5983-3
		capacitor, fixed:
		1000 pF; $\pm 10\%$; 500 V
		mechanical parts
C881 thru B85	21-62812H03	PLATE, feed-thru
	64-8005CA01	WASHER, solder
	83-755H01	
HLN4063A Power Transistor Kit (40 W High Band)		PL 6326-
HLN4081A Power Transistor Kit (40 W, 146-174 MHz)		
		transistor, see note 6
Q801	48-869960	NPIN, type M960
Q802H	48-84411103	NPIN, type M104
Q802L	48-84411104	NPIN, type M1104
note: For optimum performance, diode, transistors, and integrated circuit must be ordered by Motorola part numbers		
HLN4078A Power Amplifier Hardware Kit (136-146 MHz)		PL 6327-
HLN4002A Power Amplifier Hardware Kit (146-174 MHz)		
		capacitor, fixed:
C814, 815, 806H	21-8436FF12	200 pF $\pm 10\%$; 500 V
C840L	21-8436FF22	50 pF $\pm 5\%$; 250 V
C841L	21-8436FF12	200 pF $\pm 10\%$; 500 V
C842H	21-8436FF22	50 pF $\pm 5\%$; 250 V
C843H	21-8436FF08	40 pF $\pm 5\%$; 250 V
		mechanical parts
2-7003		NUT, 8.32 \times 5/16 \times 1/8" for Q801
3-10905A01		SCREW, machine (M3 \times 0.5 \times 8) for harm tilt and brkt
3-10904S05		SCREW, machine (M3 \times 0.5 \times 8) for Q802, 2 used
3-10936A06		SCREW, tapping (B3.5 \times 1.27 \times 8) for Q802
7-7686		WASHER, lock, 7 used
7-8007BA01		BRACKET, thermistor mount
7-90291A01		GROUND BRACKET, harmonic filter
14-80077A01		INSULATOR, PA compartment
		antenna switch mounting parts
2-80026A01		NUT, spanner
4-114529		WASHER, lock, 5/8 int
32-80080A01		GASKET
		feed thru plate
3-10904A02		SCREW, machine (M3.5 \times 0.6 \times 3); 3 used

POWER AMPLIFIER

75 or 110 WATT, 146-174 MHz
MODEL HLD1032A

FUNCTION

Increases power output of radio to 75 or 110 watts. Contains circuitry to sense temperature and current of final amplifier for application to power control and protection circuit in radio.



SHOWN FROM COMPONENT SIDE

- NOTES
1. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS
 2. INDICATES MICROSTRIP TRANSMISSION LINE
 3. INDICATES PA REF (A-1)
 4. INDICATES CHASSIS REF
 5. ALL PARTS MAY BE REMOVED FROM THE TOP OF THE BOARD
 6. RANGE SENSITIVE PART VALUE. VALUE SHOWN IS FOR RANGE II. SEE PARTS LIST FOR RANGE I VALUE
 7. RANGE SENSITIVE PART. USED ON RANGE II ONLY
 8. RANGE SENSITIVE PART. USED ON RANGE I ONLY

CAUTION
WHEN MOUNTING TRANSISTORS
DO NOT OVERTIGHTEN (BEYOND
5-7 INCH POUNDS) OR DAMAGE
TO TRANSISTORS MAY RESULT.

EEPS-26778-A

PARTS LIST SHOWN ON BACK

68P81040E53-A
8/1/82-TP

POWER AMPLIFIER

MODEL HLN4020A

Encodes and decodes sub-audible "Private-Line" tones. Encoder modules transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off reverse tone burst. Decoder detects received tone and unquelsches receiver when proper tone is received.

HLN4020A Tone "Priv

P3 2

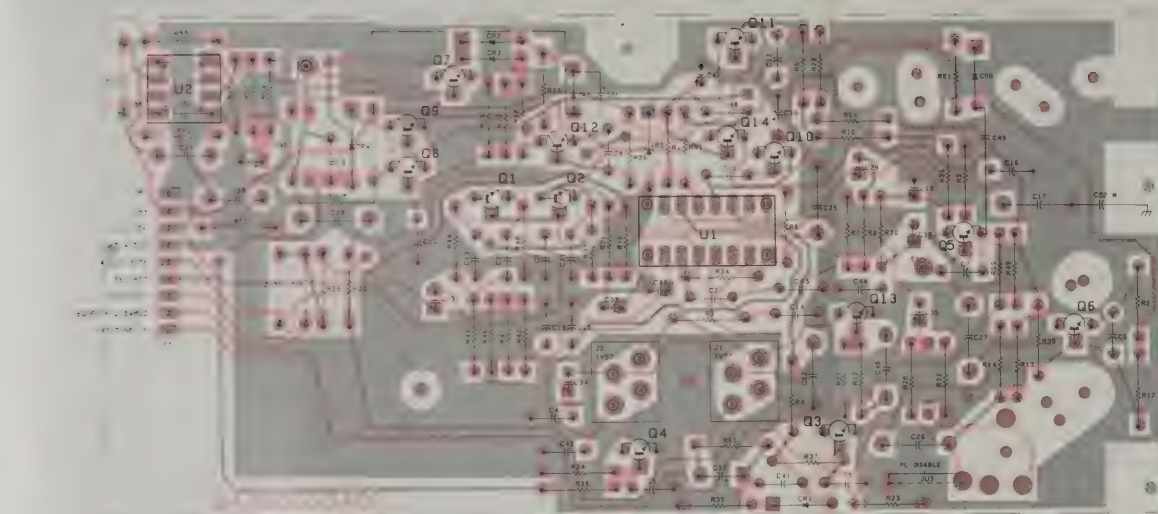
WITH MICROPHONE

68P81039E22-C
8/1/82-TP

parts list

Legend		
L = 136-146 MHz		
H = 146-174 MHz		
HLN4005A Hardware Kit		
HLD4041A Power Amplifier Board (136-146 MHz)		
HLD4042A Power Amplifier Board (146-174 MHz)		
HLD4067A Power Transistor Kit		
PL-6264-A		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed: pF ± 5%; 500 V; unless otherwise stated		
C801	21-863629	330 ± 10%; 600 V
C802	21-82372C10	.05 uF + 80-20%; 25 V
C803L	21-84493B59	39
C803H	21-83406D77	30
C804L	21-80067A57	62; 200 V
C804H	21-84493B59	39
C805L, 806L	21-84493B63	75
C805H, 806H	21-83406D77	30
C807L, 808L	21-84493B23	120; 200 V
C807H, 808H	21-84493B65	100
C809	21-84493B66	150
C810	21-83596E10	220 ± 20%
C811, 812	21-84493B63	75
C813L, 814L	21-84493B23	120; 200 V
C813H, 814H	21-84493B64	91
C816	8-82096J18	0.1 ± 10%; 250 V
C817	21-83596E10	220 ± 20%
C818	8-82096J08	.022 uF ± 10%; 250 V
C819L thru 822L	21-84493B26	22; 200 V
C819H thru 822H	21-84493B35	19
C823L, 824L	21-80067A65	100; 200 V
C823H, 824H	21-84715F26	56
C825, 826	21-80069B01	310; 350 V
C827, 828	21-82372C10	.05 uF + 80-20%; 25 V
C829	21-83596E10	220 ± 20%
C830H thru 833H	21-80169A74	60
C834L thru 837L	21-84493B47	70; 200 V
C834H thru 837H	21-80169A74	60
C838L	21-84395B54	170; 250 V
C838H	21-84395B47	140; 350 V
C840	21-863629	330 ± 10%; 600 V
C842	21-84395B48	66; 250 V
C843	21-84395B41	19; 350 V
C845L	21-84395B35	240 ± 10%; 350 V
C845H	21-84395B46	150 ± 10%; 250 V
C847	21-84395B35	240 ± 10;; 350 V
C848L	21-84395B51	16; 250 V
C848H	21-84395B45	12; 350 V
C849L	21-84395B50	36; 250 V
C849H	21-84395B28	32; 350 V
C850L, 851L	21-84395B49	46; 250 V
C850H, 851H	21-84395B36	40; 350 V
C852L	21-84395B50	36; 250 V
C852H	21-84395B39	30; 350 V
C853L	21-84395B52	17; 250 V
C853H	21-84395B38	11; 350 V
C855, 856, 857	21-83596E10	220 ± 20%
C858	23-84538G04	15 uF ± 20%; 20 V
C859	8-82096J20	0.22 uF ± 10%; 250 V
C860L thru 863L	21-84493B47	70; 200 V
C864	21-82187B07	.00047 uF ± 10%
C865	21-83596E10	220 ± 20%
C870	21-83596E10	220 ± 20%
diode: (see note)		
CR801, 803, 804	48-82466H13	silicon
CR805	48-82178A06	germanium
coil:		
L801L	24-83884G08	5-1/2 turns
L801	24-83884G01	3-1/2 turns
L802	24-82723H27	choke; 1.2 uH
L803	24-80036A02	choke; ferrite 1/2 turn
L804	24-80277A01	12.5 turns
L805	7-80062B02	1/2 turn; stamped
L806, 807	24-80036A02	choke; ferrite 1/2 turn
L808	24-80277A05	1.5 turns
L809, 810	24-82723H27	choke; 1.2 uH
L811	24-80277A04	7.5 turns
L812L	7-80062B02	1/2 turn; stamped
L812H	7-80062B04	1/2 turn; stamped
L813	24-80277A08	1.5 turns
L814	24-80277A09	6.5 turns
L815 thru 818	24-80277A02	6.5 turns
L820	24-82723H24	choke; 0.14 uH
L821	24-80036A02	choke; ferrite 1/2 turn
transistor: (see note)		
Q801	48-869860	NPN; type M9860 (HLD4067A)
Q802	48-869583	NPN; type M9583 (HLD4067A)
Q803, 804	48-84411L04	NPN; type M1104 (HLD4067A)
Q805	48-869643	PNP; type M9643

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
resistor, fixed; ± 5%; 1/4 W; unless otherwise stated		
R801	17-80068B01	.01; 10 W
R802	6-124A51	1.2k
R803	6-124A41	470
R804	6-124A56	2k
R806	6-124C33	220 ± 10%
R807L	6-125A31	180; 1/2 W
R807H	6-125A41	470; 1/2 W
R808L, 809L	6-124A20	62
R808H, 809H	6-124A09	22
R810L	6-125A31	180; 1/2 W
R810H	6-125A41	470; 1/2 W
R811	6-125C01	10 ± 10%; 1/2 W
R812	6-127C17	47 ± 10%; 2 W
R813	17-82036G07	1.5; 2 W
R814	6-125B61	4.7; 1/2 W
R815, 816	6-125C03	12 ± 10%; 1/2 W
R817, 818	17-82036G11	33 ± 10%; 2 W
R819	6-127C01	10 ± 10%; 2 W
R822	17-82291B24	0.1; 3 W
R823	6-124A42	510
R824	6-124A91	56k
R825	6-124A37	330
R826	18-80268B03	variable; 10k
R827	6-125B61	4.7; 1/2 W
R830	6-125C97	100k
thermistor: 100 @ 25 °C		
RT801	6-83600K09	
mechanical parts		
	7-80078A01	BRACKET, thermistor mounting
	15-80053B01	COVER, HF shield
	32-80080A01	GASKET, antenna connector
	15-80135A01	HOUSING (75/110 W models)
	14-80143A02	INSULATOR, HI band
	3-10905A01	SCREW, machine (M3X0.5 x 6) 4 used
	2-7003	NUT, 8-32 x 5/16 x 1/8 hex; 2 used
	3-10936A06	SCREW, tapping (M3.5 x 1.27 x 8); 6 used
	3-10904A02	SCREW, machine (M3.5 x 0.6 x 6) 3 used
	2-80006A01	NUT, spanner
	4-114522	LOCKWASH, antenna switch
	29-80014A01	CLIP, coaxial; 2 used
	26-80070B01	SHIELD PA
	3-10905A05	SCREW, machine (M3 x 0.5 x8) 4 used
	26-80018C01	HEATSINK
	26-80052B01	HF SHIELD



TRANSISTOR BASE
DETAILS
(BOTTOM)

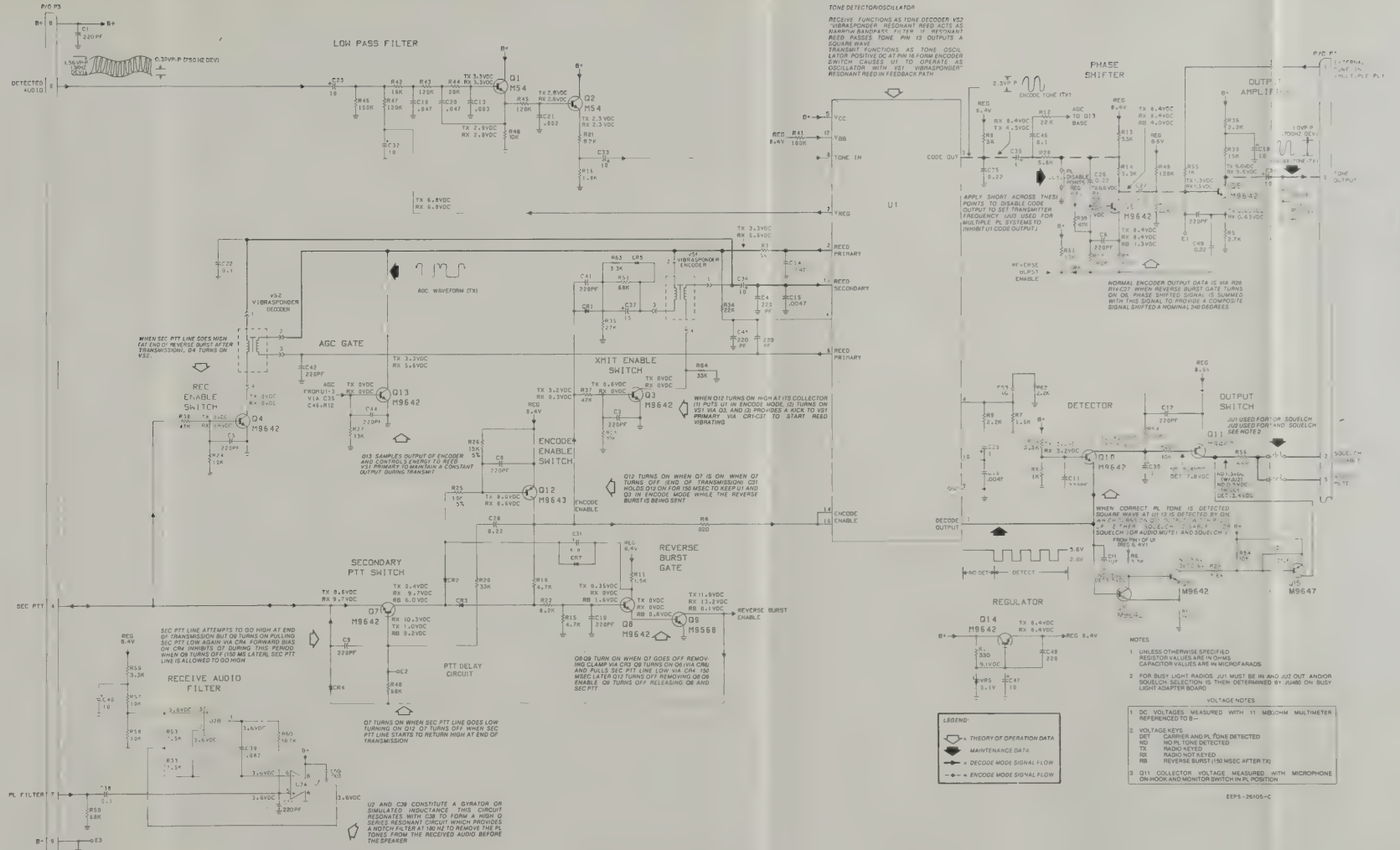


* MOUNTED ON SOLDER SIDE OF BOARD

parts list

REFERENCE SYMBOL		MOTOROLA PART NO.		DESCRIPTION
C1, 2, 3		21-83596E10	220 pF ± 20%, 500 V	capacitor, fixed
C4		23-84038G01	1 uF ± 20%, 35 V	capacitor, electrolytic
C5		21-82187B44	100 uF ± 10%, 100 V	capacitor, electrolytic
C6		21-82187B46	100 uF ± 10%, 100 V	capacitor, electrolytic
C7		21-83596E38	0.047 uF ± 10%, 100 V	capacitor, electrolytic
C8		8-83813H38	0.05 uF ± 10%, 100 V	capacitor, electrolytic
C9		23-84665F01	10 uF ± 100-10%, 20 V	capacitor, electrolytic
C10		8-84637L31	0.047 uF ± 10%, 250 V	capacitor, electrolytic
C11		21-82428B28	0.022 uF ± 10%, 200 V	capacitor, electrolytic
C12		21-82377C09	0.1 uF ± 80-20%, 25 V	capacitor, electrolytic
C13		23-84665F01	10 uF ± 100-10%, 20 V	capacitor, electrolytic
C14		8-84637L22	0.22 uF ± 10%, 100 V	capacitor, electrolytic
C15		23-84665F04	1 uF ± 150-10%, 50 V	capacitor, electrolytic
C16		23-84538G22	6.8 uF ± 10%, 20 V	capacitor, electrolytic
C17		23-84665F01	10 uF ± 100-10%, 20 V	capacitor, electrolytic
C18		8-84637L37	0.1 uF ± 5%, 100 V	capacitor, electrolytic
C19		8-84637L36	0.02 uF ± 5%, 100 V	capacitor, electrolytic
C20		23-84665F01	10 uF ± 100-10%, 20 V	capacitor, electrolytic
C21		21-83596E10	0.0022 uF ± 20%, 500 V	capacitor, electrolytic
C22		21-82428B28	0.022 uF ± 10%, 100 V	capacitor, electrolytic
C23		21-83596E10	0.0022 uF ± 20%, 500 V	capacitor, electrolytic
C24		8-84637L22	0.22 uF ± 10%, 100 V	capacitor, electrolytic
C25		21-82187B44	100 uF ± 10%, 100 V	capacitor, electrolytic
C26		21-83596E10	0.0022 uF ± 20%, 500 V	capacitor, electrolytic
C27		21-84493B41	100 pF ± 10%, 750 V	capacitor, electrolytic
C28		23-84665F01	10 uF ± 100-10%, 20 V	capacitor, electrolytic
C29		8-83554H01	silicon	diode (see note)
C30		8-82187B40	germanium	diode
C31		8-83554H01	silicon	diode
J1, 2		9-80132A01	connector, receptacle	J1 & J2 each consist of four 9-80132A01 parts
P1		28-90181B02	connector, plug	male 9 contact
REFERENCE SYMBOL		MOTOROLA PART NO.		DESCRIPTION
Q1, 2		48-134674	transistor (see note)	NPN, type M9642
Q3		48-809642	NPN, type M9642	
Q4		48-809658	NPN, type M9642	
Q5		48-809642	NPN, type M9642	
Q6		48-809642	NPN, type M9642	
Q7		48-809642	NPN, type M9642	
Q8		48-809642	NPN, type M9642	
Q9		48-809642	NPN, type M9642	
Q10		48-809642	NPN, type M9642	
Q11		48-809642	NPN, type M9642	
Q12		48-809642	NPN, type M9642	
Q13		48-809642	NPN, type M9642	
Q14		48-809642	NPN, type M9642	
Q15		48-809642	NPN, type M9642	
Q16		48-809642	NPN, type M9642	
Q17		48-809642	NPN, type M9642	
R1		6-124A33	330	resistor, fixed ± 5%, 1/4 W
R2		6-124A44	620 ± 5%	resistor, fixed ± 5%, 1/4 W
R3		6-124C3	820	resistor, fixed ± 5%, 1/4 W
R4		6-124C61	3.3k	resistor, fixed ± 5%, 1/4 W
R5		6-124A50	2.7k ± 5%	resistor, fixed ± 5%, 1/4 W
R6		6-124C53	1.5k	resistor, fixed ± 5%, 1/4 W
R7		6-124A80	3k ± 5%	resistor, fixed ± 5%, 1/4 W
R8		6-124C57	2.2k	resistor, fixed ± 5%, 1/4 W
R9		6-124A51	1k	resistor, fixed ± 5%, 1/4 W
R10		6-124A71	1.5k ± 5%, 1/4 W	resistor, fixed ± 5%, 1/4 W
R11		6-124A81	22k ± 5%	resistor, fixed ± 5%, 1/4 W
R12		6-124A81	3.3k ± 5%	resistor, fixed ± 5%, 1/4 W
R13		6-124A81	3.3k ± 5%	resistor, fixed ± 5%, 1/4 W
R14		6-124A81	4.7k ± 5%	resistor, fixed ± 5%, 1/4 W
R15		6-124C56	1.8k	resistor, fixed ± 5%, 1/4 W
R16		6-124A71	8.2k ± 5%	resistor, fixed ± 5%, 1/4 W
R17		6-124A85	4.7k ± 5%	resistor, fixed ± 5%, 1/4 W
R18		6-124A85	33k ± 5%, 1/4 W	resistor, fixed ± 5%, 1/4 W
R19		6-124C71	8.2k	resistor, fixed ± 5%, 1/4 W
R20		6-124C73	10k	resistor, fixed ± 5%, 1/4 W
R21		6-124A73	10k ± 5%	resistor, fixed ± 5%, 1/4 W
R22		6-124A77	15k ± 5%	resistor, fixed ± 5%, 1/4 W
R23		6-124A81	22k ± 5%	resistor, fixed ± 5%, 1/4 W
R24		6-124C81	22k	resistor, fixed ± 5%, 1/4 W
R25		6-124C83	33k	resistor, fixed ± 5%, 1/4 W
U1		51-84788F7	type M8876	integrated circuit (see note)
U2		51-84621K78	type M2178	integrated circuit (see note)
VRS		48-82256C38	voltage regulator	zener type: 9.1 V
REFERENCE SYMBOL		MOTOROLA PART NO.		DESCRIPTION
3-10904A22		3-10904A45	SCREW, machine (M3 5 x 0.8 x 1.3) 3 used	
4-80148A01		4-80148A01	WASHER, captive, 4 used	
7-80023A01		7-80023A01	BRACKET, rear hold-down	
29-10271A15		29-10271A15	TERMINAL, pin, 3 used	
48-80174A01		48-80174A01	STUD	
75-80173A01		75-80173A01	COMPRESSION PAD, 2 used	

note: for optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

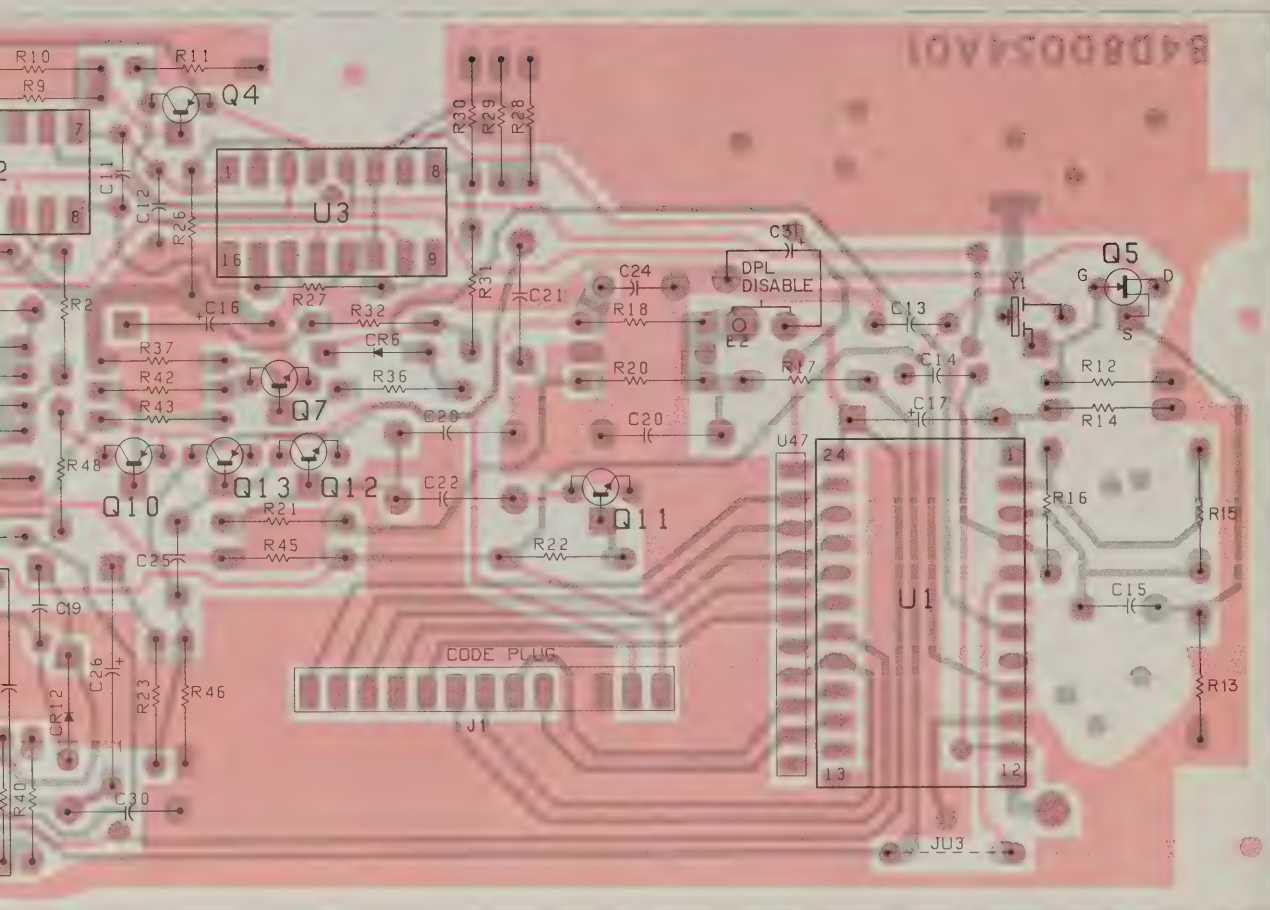


tone "PRIVATE-LINE" ENCODER/DECODER MODEL HLN4020A

FUNCTION

Encodes and decodes sub-audible "Private-Line" tones. Encoder modules transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off reverse tone burst. Decoder detects received tone and unquelsches receiver when proper tone is received.

tone "PRIVATE-LINE" ENCODER-DECODER "DIGITAL PRIVATE-LINE" ENCODER-DECODER



1 SOLDER SIDE

COMPONENT SIDE * BD-DEPS-26100-A
SOLDER SIDE * BD-DEPS-26099-A
OL-DEPS-26098-A

PL-6050-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q1	48-869648	transistor: (see note)
Q2	48-869642	NPN; type M9648
Q3, 4	48-869643	PNP; type M9643
Q5	48-869653	FET; type M9653
Q6	48-869643	PNP; type M9643
Q7	48-869642	NPN; type M9642
Q8	48-869568	NPN; type M9568
Q9, 10	48-869643	PNP; type M9643
Q11, 12	48-869642	NPN; type M9642
Q13	48-869643	PNP; type M9643
R1	6-124A93	resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated
R2	6-124A99	68k
R3, 4, 5	6-10621D64	120k
R6	6-124A55	56.2k $\pm 1\%$; 1/8 W
R7, 8	6-124A73	1.8k
R9	6-124C59	10k
R10	6-124A73	2.7k $\pm 10\%$
R11	6-124A83	10k
R12	6-124B08	27k
R13	6-124A77	270k
R14	6-124A97	15k
R15	6-124B04	100k
R16	6-124B14	180k
R17	6-124A91	470k
R18	6-124A92	56k
R20, 21	6-124A97	62k
R22	6-124C75	100k
R23	6-124A77	12k $\pm 10\%$
R24	6-124A33	15k
R25	6-124A33	220 ohms
R26	6-124A73	220 ohms
R27	6-124A89	10k
R28	6-10621D80	47k
R29	6-124B14	82.5k $\pm 1\%$; 1/8 W
R30	6-124C95	470k
R31	6-124C99	82k $\pm 10\%$
R32	6-124C95	120k $\pm 10\%$
R33	6-124C49	82k $\pm 10\%$
R34	6-124A93	1k $\pm 10\%$
R35	6-124A79	68k
R36	6-124C99	120k $\pm 10\%$
R37	6-124C95	82k $\pm 10\%$
R38	6-124A89	47k
R39	6-124C75	12k $\pm 10\%$
R40	6-124A73	10k
R41	6-124A49	1k
R42, 43	6-124C89	47k $\pm 10\%$
R44	6-124D08	270k $\pm 10\%$; 1/4 W
R45	6-124A93	68k
R46	6-124A49	1k
R48	6-124C33	220 ohms $\pm 10\%$

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
U1	51-84267A82	integrated circuit: (see note)
U2	51-84320A55	type M6782
U3	51-84320A79	type LM565CN
U47	51-82142K02	type CA3096AE
VR10	48-83696E07	resistor network
VR11	48-82256C11	voltage regulator: (see note)
Y1	48-82003K01	Zener, 6.2 V
		Zener, 10 V
		crystal, resonator:
		50 kHz
mechanical parts		
	14-861196	INSULATOR, transistor
	3-10904A02	SCREW, machine: M3.5 x 0.6 x 6
	3-10904A15	SCREW, machine: M3.5 x 0.6 x 13; 3 used
	4-80149A01	WASHER, captive; 4 used
	29-10271A15	TERMINAL, pin; 2 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

DIGITAL PRIVATE-LINE™ TWO-CODE ADAPTER

MODEL TLN5730A

APPLICATION —

Plugs into code plug receptacle on "Digital Private-Line" decoder or encoder-decoder to allow separate "Digital Private-Line" codes for transmit and receive. Plug the plugs for the two codes then plug into the receptacles on the two-code adapter board.

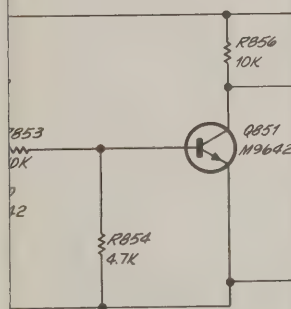
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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RECEIVE
CODE SWITCH

PARTS LIST

5730A 2-Code Adapter Board

PL-3414-O



50 thru 867	48-83654H01	DIODE: (SEE NOTE) silicon
, 851	9-82071K01	CONNECTOR, receptacle: female; 12-contact
		CONNECTOR, plug: consists of: 28-82070K01 CONTACT, male; 13 req'd.
, 851	48-869642	TRANSISTOR: (SEE NOTE) NPN; type M9642
, 852,	6-124A73	RESISTOR, fixed: 10k ±5%; 1/4 W
856		
, 854	6-124A65	4.7k ±5%; 1/4 W

NON-REFERENCED ITEMS

1V80769B88	CIRCUIT BOARD ASSY., incl. referenced item P850
3-138804	SCREW, machine: 4-40 x 5/16"; 2 req'd.

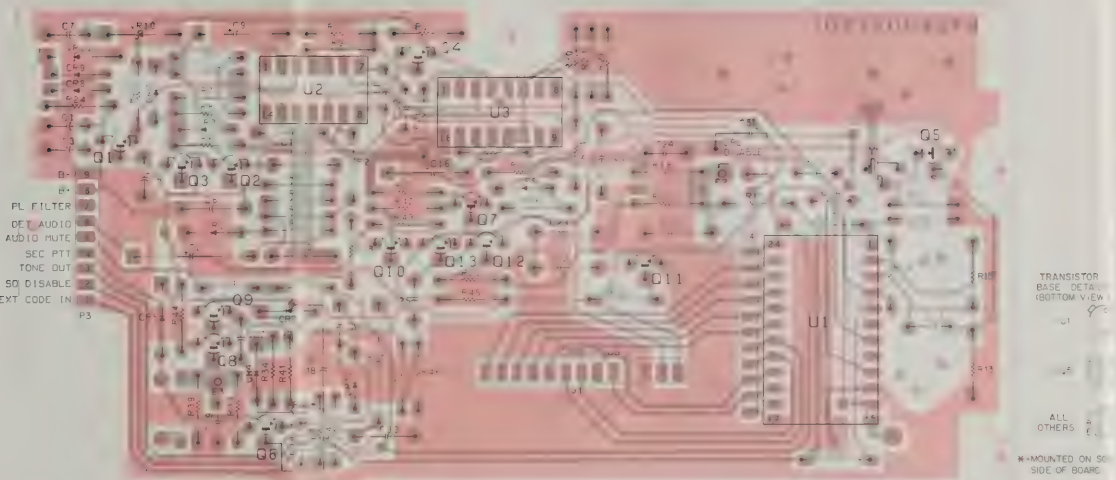
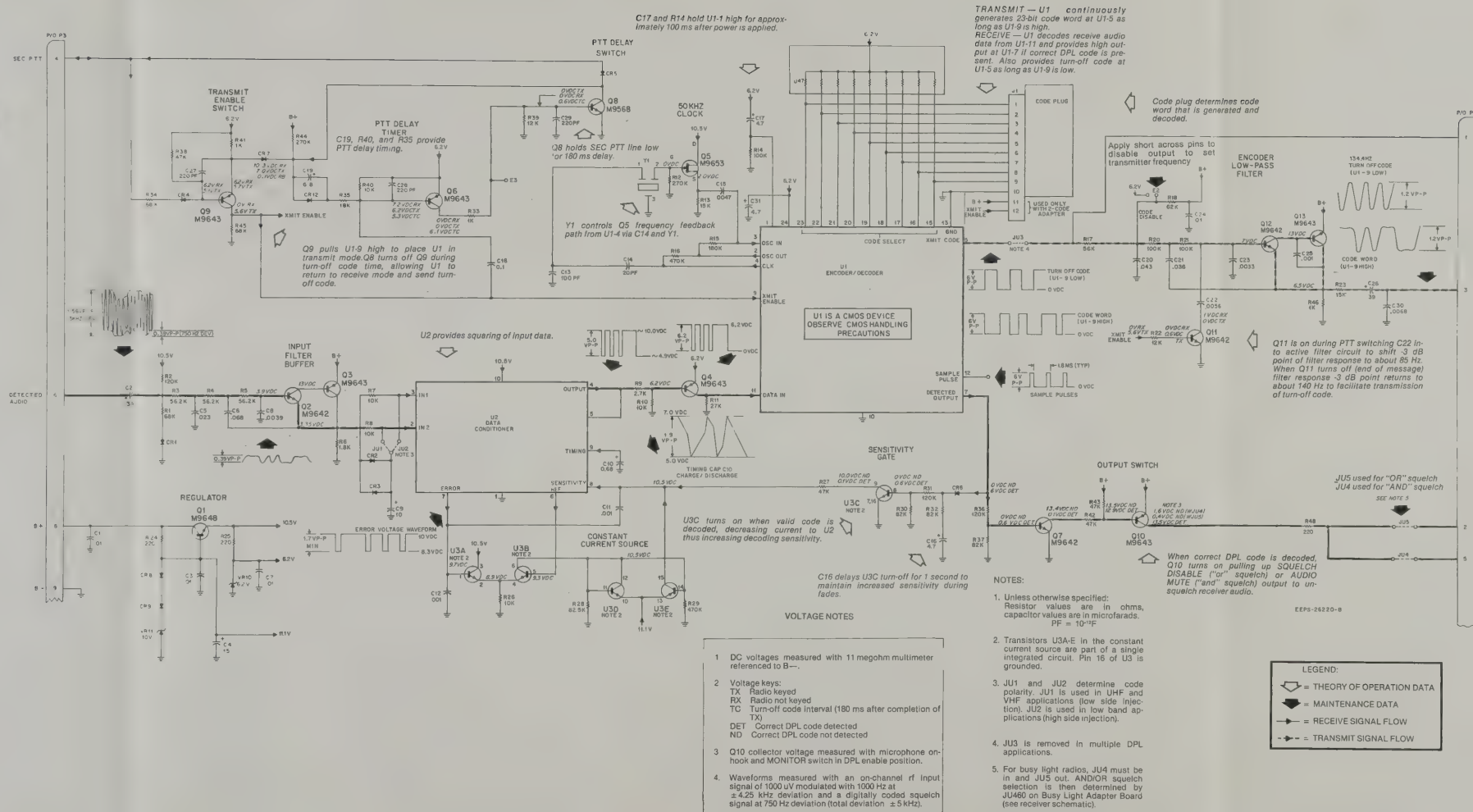
LOW ON T
LINE ENA
RECEIVE
E: For optimum performance, diodes and transistors must
be ordered by Motorola part number.

DPL TWO-CODE ADAPTER/MITREK ACCESSORIES

68P81106E97-B
8/1/82-TP

MODEL HLN4011A

Encodes and decodes "Digital Private-Line" codes. Encoder modulates transmitter and delays transmitter turn-off 150 ms to allow transmission of turn-off code. Decoder detects received tone and unquelsches receiver when proper code is received.



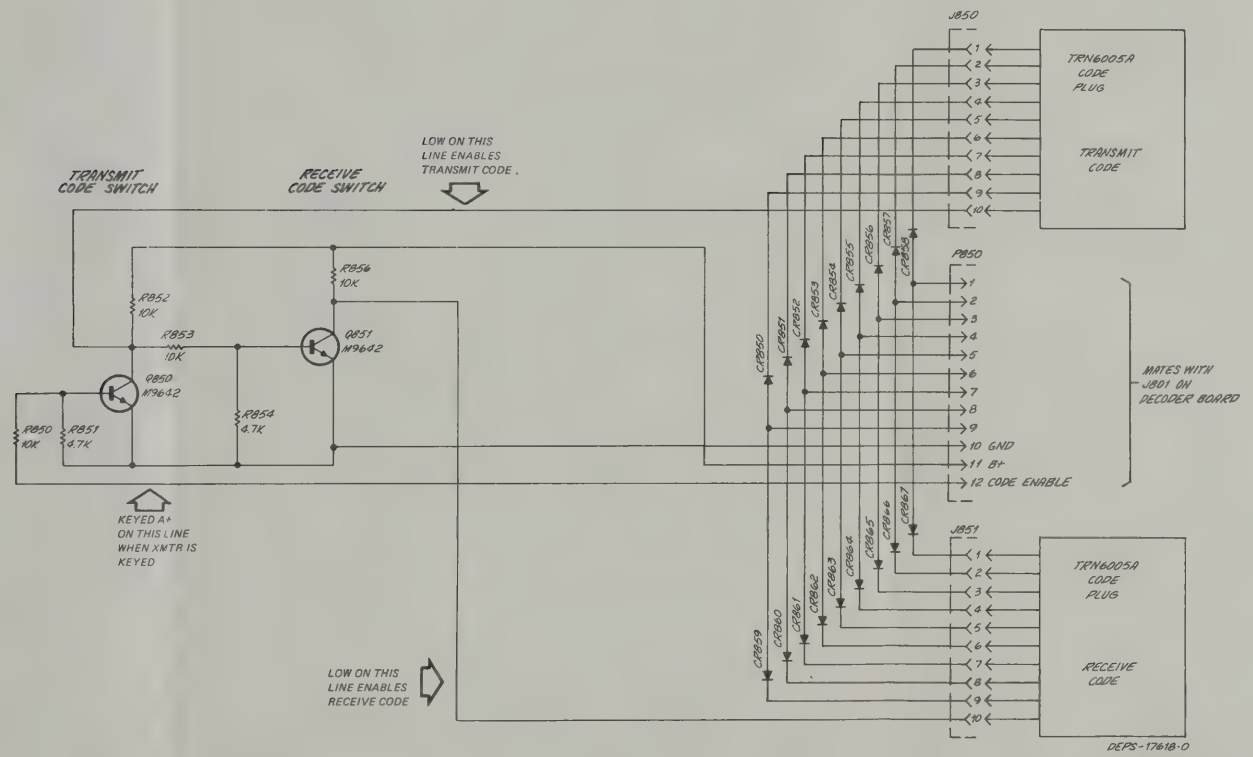
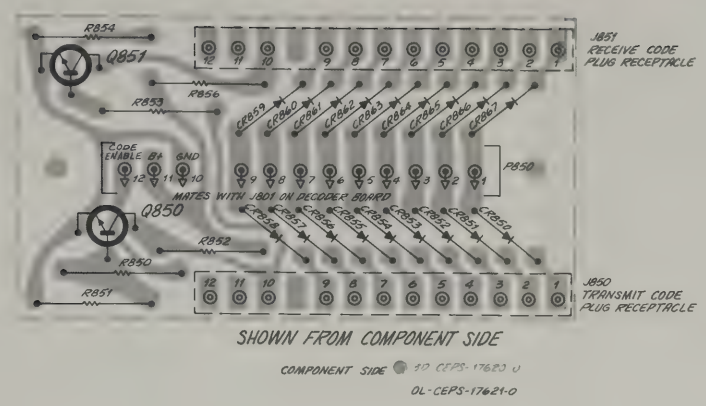
SHOWN FROM SOLDER SIDE

HLN4011A "Digital Private-Line" Encoder/Decoder Board | PL-6050-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitors, fixed; $\pm 5\%$, 50 V; unless otherwise stated	Q1	48-806646	transistor: (see note)	R35	6-12A479	18k
			Q2	48-806642	NPN, type M9648	R36	6-12A439	120k $\pm 10\%$
C1	21-8359636	.01 ± 60 -40%, 250 V	Q3, 4	48-806643	PNP, type M9643	R37	6-12A436	82k $\pm 10\%$
C2	23-8278336	.39 $\pm 10\%$, 10 V	C5	48-806653	FET, type M9653	R38	6-12A480	47k
C3	23-8453004	15 $\pm 20\%$, 250 V	D6	48-806643	PNP, type M9643	R39	6-12A475	12k $\pm 10\%$
C5	8-8205933	.023	D7	48-806642	NPN, type M9642	R40	6-12A473	10k
C6	8-83813H23	.068	D8	48-806658	NPN, type M9658	R41	6-12A449	47k $\pm 10\%$
C7	21-8359636	.01 ± 60 -40%, 250 V	D9, 10	48-806643	PNP, type M9643	R42, 43	6-12A420	270k $\pm 10\%$, 1/4 W
C8	8-83813H19	.0038	C11, 12	48-806642	PNP, type M9642	R44	6-12A483	88k
C9	23-8278303	10 $\pm 10\%$, 20 V	C13	48-806643	PNP, type M9643	R46	6-12A449	1k
C10	23-8278348	.66 .36 V			resistor: fixed; $\pm 5\%$, 1/4 W; unless otherwise stated	R45	6-12A433	220 ohms $\pm 10\%$
C11, 12	21-82187844	.001 $\pm 10\%$, 100 V	R1	6-12A483	68k			Integrated circuit: (see note)
C13	21-80077465	100 pF, 200 V	R2	6-12A499	120k	U1	51-84267A82	type M6782
C14	21-80067440	20 pF, 500 V	R3, 4, 5	6-10821D84	56.2k $\pm 1\%$, 1/8 W	U2	51-84320A55	type LM6505CN
C15	21-8359638	.0047 $\pm 10\%$, 100 V	R6	6-12A455	1.8k	U3	51-84320A79	type CA-3096A
C16	23-8412807	4.7 $\pm 20\%$, 10 V	R7, 8	6-12A473	10k	R47	51-82142K02	resistor network
C17	6-82096118	1.0 $\pm 10\%$, 250 V	R9	6-12A458	2.7k $\pm 10\%$			voltage regulator: (see note)
C19	23-84538G22	6.8 $\pm 10\%$, 20 V	R10	6-12A473	10k	VR10	48-8309607	Zener, 6.2 V
C20	6-83813H14	.04	R11	6-12A483	27k	VR11	48-82256C11	Zener, 10 V
C21	6-83813H24	.038	R12	6-12A480	270k			
C22	6-83813H26	.0056	R13	6-12A477	15k			crystal, resonator
C23	6-83813H27	.0033, 10 V	R14	6-12A497	100k	Y1	48-82003G01	50 MHz
C24	21-8359636	.01 ± 60 -40%, 250 V	R15	6-12A480	180k			mechanical parts
C25	21-82187844	.001 $\pm 10\%$, 25 V	R16	6-12A481	470k		14-861196	INSULATOR, transistor
C26	23-8278336	.39 $\pm 10\%$, 10 V	R17	6-12A481	56k		3-10904A15	SCREW, machine, M3.5 $0.6 \times 6 \times 8$
C27, 28, 29	21-8359636	220 pF $\pm 20\%$, 500 V	R18	6-12A482	62k		3-10904A15	SCREW, machine, M3.5 $0.6 \times 13 \times 3$, used
C30	8-8446DC08	.0095 $\pm 10\%$, 400 V	R20, 21	6-12A497	120k		4-80160A01	WASHER, cap, used
C31	23-84538G02	4.7 μF $\pm 20\%$, 20 V	R22	6-12A475	12k $\pm 10\%$		29-10271A15	TERMINAL, pin, 2 used
			R23	6-12A477	15k			
CR1	48-83854H02	silicon	R24	6-12A433	220 ohms			note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers
CR2, 3	48-84616A01	silicon, hot-carrier	R25	6-12A433	220 ohms			
CR4	48-83854H01	silicon	R26	6-12A473	10k			
CR5	48-82178A01	germanium	R27	6-12A489	47k			
CR6 thru 9, 12	48-83854H01	silicon	R28	6-10821D80	82.5k $\pm 1\%$, 1/8 W			
			R29	6-12A481	470k			
			R30	6-12A436	82k $\pm 10\%$			
			R31	6-12A439	120k $\pm 10\%$			
			R32	6-12A436	82k $\pm 10\%$			
			R33	6-12A449	1k $\pm 10\%$			
			R34	6-12A493	66k			
J1	9-82071K01	connector, receptacle: female, 12-contact						
P3	28-80181B02	connector, plug: male, 9-contact						

“DIGITAL PRIVATE-LINE”
TWO-CODE ADAPTER

MODEL TLN5730A



APPLICATION —

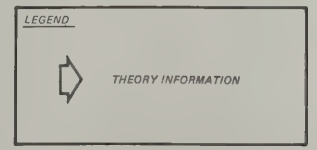
Plugs into code plug receptacle on “Digital Private-Line” decoder or encoder-decoder to allow separate “Digital Private-Line” codes for transmit and receive. Code plugs for the two codes then plug into the receptacles on the two-code adapter board.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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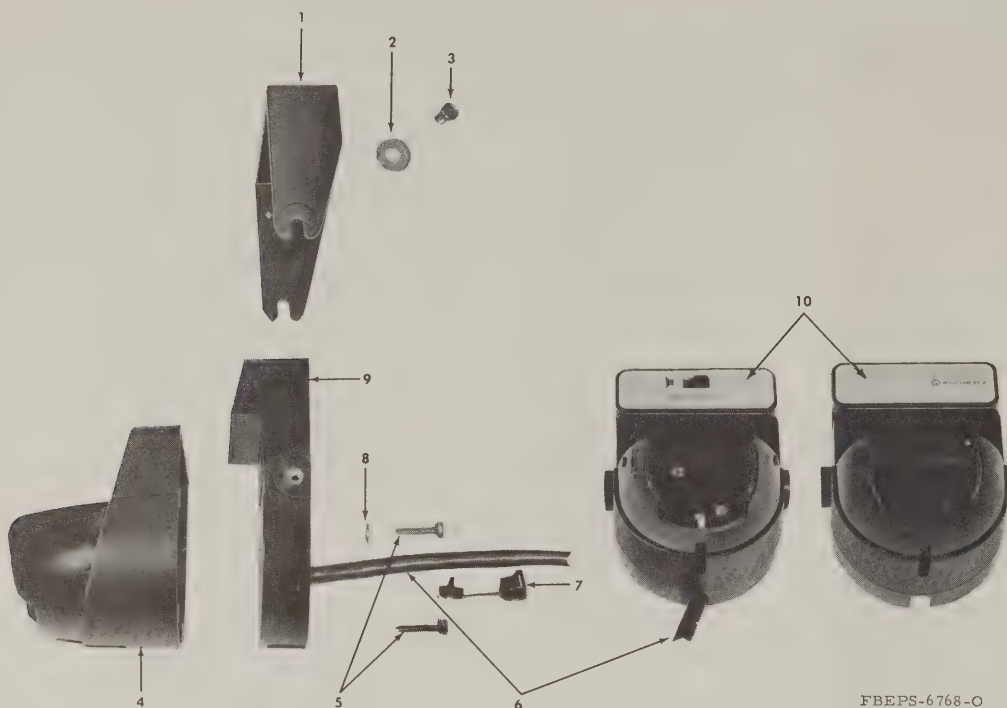
PARTS LIST

TLN5730A 2-Code Adapter Board		PL-3414-O
CR850 thru 867	48-83654H01	DIODE; (SEE NOTE) silicon
J850, 851	9-82071K01	CONNECTOR, receptacle: female; 12-contact
P850		CONNECTOR, plug: consists of: 28-82070K01 CONTACT, male; 13 req'd.
Q850, 851	48-869642	TRANSISTOR; (SEE NOTE) NPN; type M9642
R850, 852, 853, 856	6-124A73	RESISTOR, fixed: 10k ±5%; 1/4 W
R851, 854	6-124A65	4.7k ±5%; 1/4 W
NON-REFERENCED ITEMS		
	1V80769B88	CIRCUIT BOARD ASSY., incl. referenced item P850
	3-138804	SCREW, machine: 4-40 x 5/16"; 2 req'd.

NOTE: For optimum performance, diodes and transistors must be ordered by Motorola part number.



DPL TWO-CODE ADAPTER/MITREK ACCESSORIES



FBEPS-6768-O

HANDSET HANGUP BOX

Handset hangup boxes are used (1) to automatically place the radio in "Monitor (carrier squelch) mode" when the handset is off-hook, and (2) transfer audio from the handset speaker to the handset receiver when the handset is on-hook. Model TLN4698A is used in most installations. Model TLN4507A also contains a slide switch to place the radio in the monitor mode with the handset still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions, or when used in conjunction with a carrier squelch control head. The TLN4505A Hangup Cup is supplied with carrier squelch

parts list

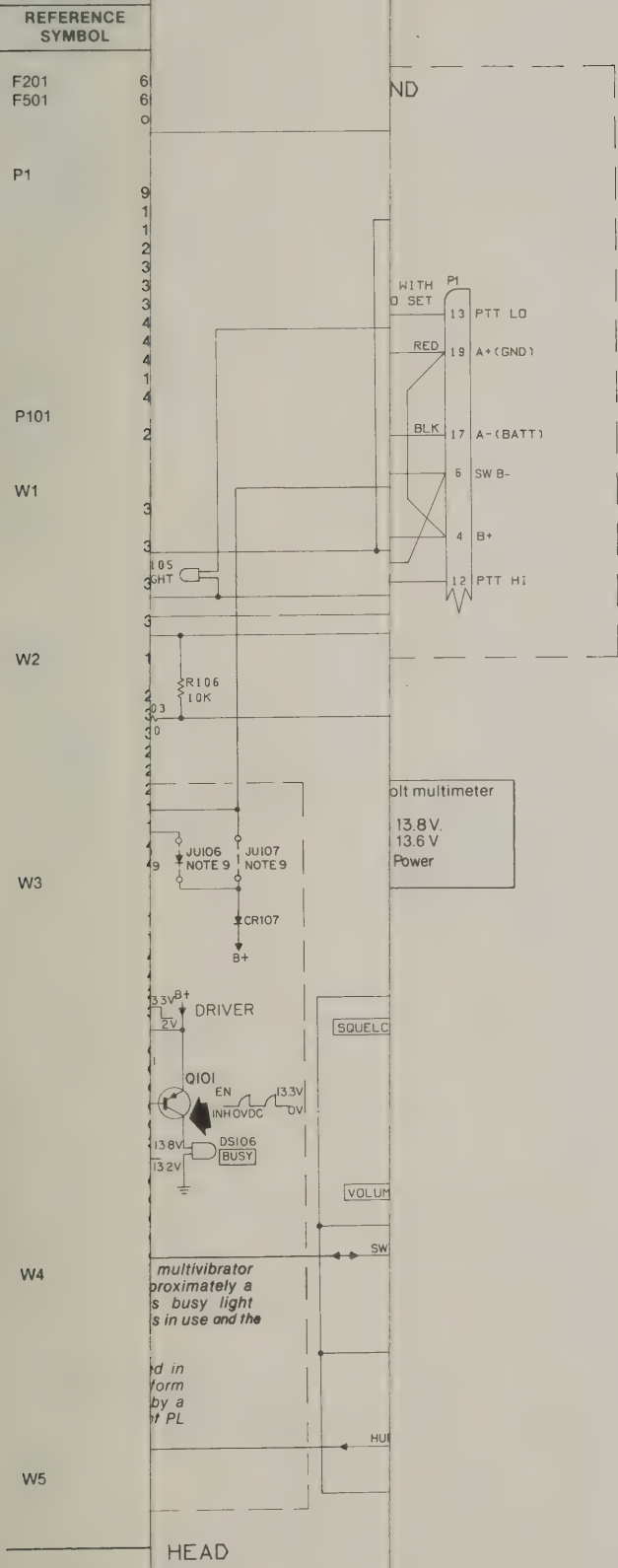
Hang-Up Boxes

PL-6063-A

CODE	MOTOROLA PART NO.	DESCRIPTION
1	7C84568B02	BRACKET, trunnion
2	4S1724	WASHER, flat: 0.234" x 0.625" x .048"
3	3S7302	SCREW, machine: 10-32 x 3/8" "Phillips" hex head
4	15C84520C01 or 15C84520C02	HANG-UP CUP & SWITCH ASSEMBLY HANG-UP CUP (TLN4505A)
5	3S135507	SCREW, machine: 6-32 x 3/4" "Phillips" hex head
6	1V80717B42 or 1V80727B32	CABLE ASSEMBLY; includes attached insertable connector contacts (TLN4507A) CABLE ASSEMBLY; includes attached insertable connector contacts (TLN4698A)
7	42B82018H08	ANCHOR, cable strain relief
8	4S1720	WASHER, flat: 0.156" x 0.378" x .030"
9	1V80717B40 or 58D84514C01	MOUNTING BASE & SWITCH ASSEMBLY (TLN4507A) MOUNTING BASE (TLN4698A and TLN4505A)
10	13B84515C01 or 13B84515C02	ESCUTCHEON (TLN4507A) ESCUTCHEON (TLN4698A and TLN4505A)
non-coded items		
	42B82018H08	RETAINER, cable (TLN4698A)
	3S136756	SCREW, tapping: 20 x 5/8" (TLN4698A)
	38B84383D01	CAP, protective

parts list

Low Power	High Power
HKN4000A, HKN401	
HKN4001A, HKN401	
HKN4002A, HKN401	
HKN4003A, HKN401	
HKN4004A, HKN402	
HKN4005A, HKN402	
HKN4006A, HKN402	



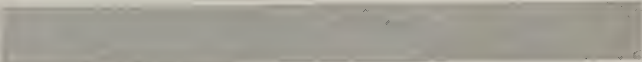
MITREK CONTROL HEADS

MODELS HCN4000-11A

MITREK RADIO CABLES

MODELS HKN4000-6A

HKN4016-22A



FUNCTION

The control head provides control of the trunk-mounted radio from the vehicle passenger compartment. It controls frequency selection, volume, and squelch. A PL MONITOR switch is provided for "Private-Line" radios. The radio cable interconnects the control head and radio and includes primary power connections.

parts list

HKN4040A Fused Lead, Positive Ground
HKN4041A Fused Lead, Negative Ground PL-6245-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
W5	30-812505	LEAD, fused consists of: CABLE, battery, red; 2-1/2' (used on HKN4041A only)
	or 30-851875	CABLE, battery, black; 2-1/2' (used on HKN4040A only)
	29-84528B05	LUG, ring tongue
	9-84277B01	RECEPTACLE, fuse
	3-400465	SCREW, tapping
	42-84275B01	RETAINER, fuse
F501	38-84383D01	CAP, protection
	65-61683	FUSE, 5AG-40 Ampere

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

CONTROL HEAD AND CABLES

MITREK ACCESSORIES

SPEAKER

The HSN4000A Speaker provides the audio output from the radio. It is equipped with its own trunnion bracket and may be mounted on the firewall or dashboard near the radio. The speaker is mounted in a strong, weather-resistant housing.

parts list

HSN4000A Speaker			PL-6060-C
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
LS301	50-84561B02	speaker: dia. 5" PM	
mechanical parts			
	3-140001	SCREW, tapping; 6-7/8"	
	3-84244C01	SCREW, trunion; 2 used	
	7-84568B01	BRACKET, trunion	
	13-82671M02	BEZEL, speaker	
	15-84981B09	COVER, speaker base	
	32-80195A01	GASKET, speaker	
	38-84383D02	CAP, protective; 3 used	
	29-82602D01	PIN, terminal; 2 used	
	37-82603D31	SLEEVEING, coded 31	
	37-82603D32	SLEEVEING, coded 32	
	42-82018H05	RETAINER, cable	
	42-84081A03	CLAMP, wire	
	3-136756	SCREW, tapping; 10-16 x 5/8"; 3 used	
	30-83155H01	CABLE, 2 cond	

MICROPHONE HANGUP BOX

The microphone hangup boxes are used with "Private-Line" and "Digital Private-Line" radios to automatically place the radios in the monitor (carrier-squelch) mode when the microphone is lifted off-hook. Model HLN4024A is used in most installations. Model HLN4025A also contains a slide switch to place the radio in the monitor mode with the microphone still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions or when used in conjunction with a carrier squelch control head.

parts list

HLN4024A Microphone Hang-Up Box			PL-6061-C
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
S101	40-82159D02 or 40-84198C01	switch: spst open leaf (HLN4025A)	
S301	40-84622B04	spst, slide (HLN4025A)	
mechanical parts			
	3-139913	SCREW, tapping; 8-15 x 1/2"; 2 used	
	3-129075	SCREW, machine; 2-56 x 1/2"; 2 used (HLN4024A)	
	4-8406	LOCKWASHER, #2 internal; 2 used	
	7-80288A01	BRACKET, switch (HLN4024A)	
	14-80266A01	INSULATOR (HLN4024A)	
	32-05719B01	BOOT, switch (HLN4024A)	
	38-84383D01	CAP, protective; 2 used	
	42-82018H07	RETAINER, cable	
	15-80191A01	HOUSING, hang-up box	
	4-400136	WASHER, flat; .196 x .312 x .067"	
	41-867688	SPRING	
	29-82602D01	PIN, terminal; 2 used	
	37-80143B01	SLEEVEING, coded 24/30	
	37-82603D27	SLEEVEING, coded 27	
	3-135495	SCREW, tapping; 2-56 x 3/8"; 2 used (HLN4025A)	
	64-84199C01	PLATE, mounting (HLN4025A)	
	15-84626B02	HOUSING, hang-up box (HLN4025A)	
	2-7041	NUT, 2-56 x 3/16"; 2 used (HLN4024A)	

IGNITION SENSE LEAD

The optional ignition sense lead is used in systems where the green lead is connected to the battery (allowing receiver operation at all times) and it is desired to allow transmitter operation *only* when the ignition switch is on. This option includes the orange power lead and fuse; this lead supplies power to the radio PTT circuits when an optional jumper is altered in dc control head.

parts list

HKN4007A Ignition Switch Cable			PL-6058-B
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
F401	65-890033	fuse: 1-1/2 amp; 250 V	
fuseholder: includes: INSULATOR, fuse, body INSULATOR, fuse, cap SPRING CLIP, fuse; 2 used			
	14-82882A01		
	14-82883A01		
	41-82885A01		
	42-82884A01		
cable, power, orange, includes: WIRE, 18 ga. stranded, orange, 66-1/2" SLEEVEING, coded #20 PIN TERMINAL LUG, soldering LUG, ring tongue LUG, ring tongue			
	30-10310A62		
	37-82603D20		
	29-82602D01		
	29-136968		
	29-824456		
	29-865065		

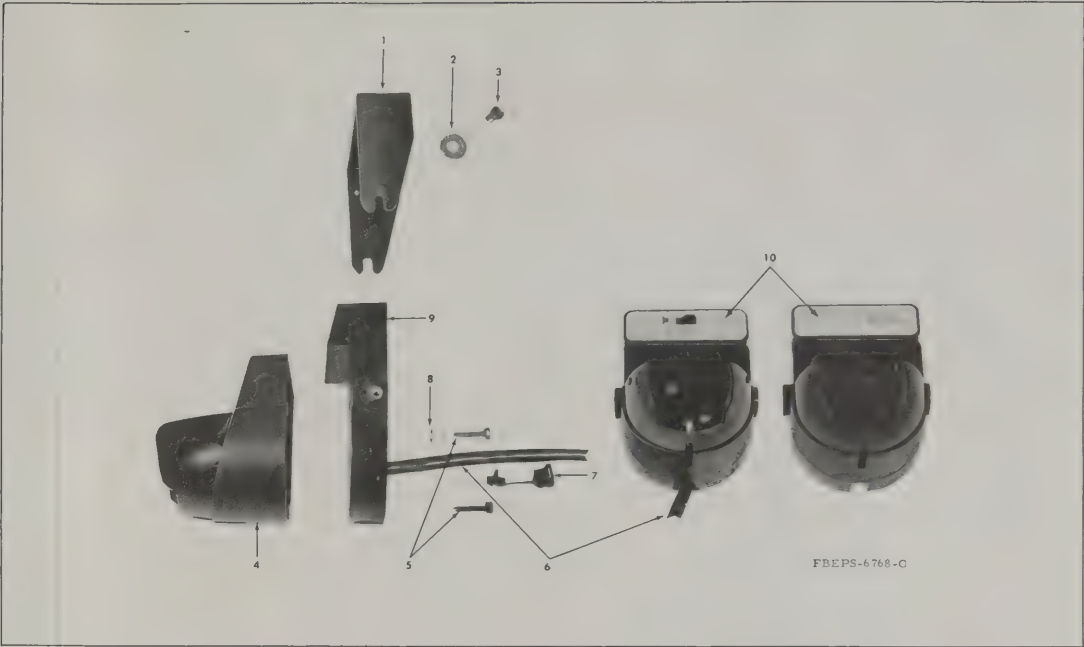
HANDSET

The TMN6057A Handset is used in installations where a telephone-style handset is preferred to the mobile microphone and speaker. The unit operates in the same manner as a telephone handset except that it has a PTT button which is used to key the radio.

parts list

TMN6057A HANDSET			PL-6064-A
CODE	MOTOROLA PART NO.	DESCRIPTION	
1	15B84054A01	CAP, receiver (see note)	
2	59C84058A01	CARTRIDGE, receiver	
3	15C84059A01	HANDLE (see note)	
4	3S124432	SCREW, machine: 4-40 x 1/4" "Phillips" flat head; 2 req'd.	
5	40C84087A01	SWITCH, push; includes pushbutton and dust cover	
6	15B84053A01	PLATE, switch cover	
7	15B84055A01	CAP, transmitter (see note)	
8	59B83272G01	MICROPHONE ELEMENT, telephone; dynamic type	
9	7B83352H01	BRACKET, cord retaining	
10	1D84519C01	CORD ASSEMBLY; includes a "molded-on" 5-contact female connector	
12		CONNECTOR, plug; 5-contact; "molded-on"	

note: A replacement handle, plus transmit and receiver caps, can be obtained by ordering Part No. 15C84107A01.



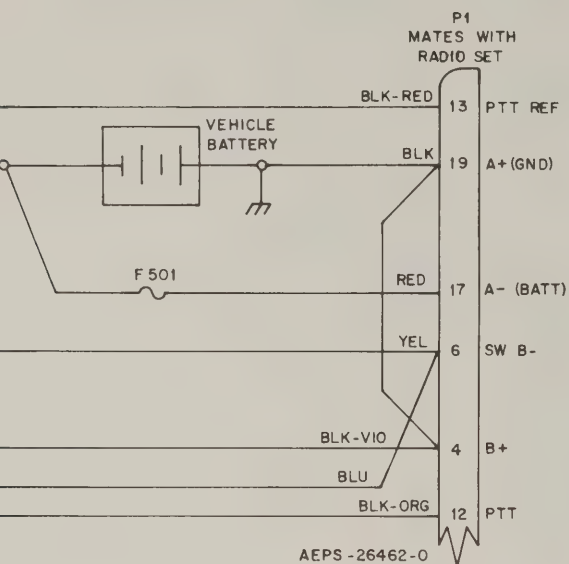
HANDSET HANGUP BOX

The handset hangup boxes are used (1) to automatically place "Private-Line" and "Digital Private-Line" radios in the monitor (carrier squelch) mode when the handset is lifted off-hook, and (2) transfer audio from the mobile speaker to the handset receiver when the handset is lifted off-hook. Model TLN4698A is used in most installations. Model TLN4507A also contains a slide switch to place the radio in the monitor mode with the handset still on-hook; this model is used in situations where the normal MONITOR switch on the control head is used for special functions. or when used in conjunction with a carrier squelch control head. The TLN4505A Hangup Cup is supplied with carrier squelch models.

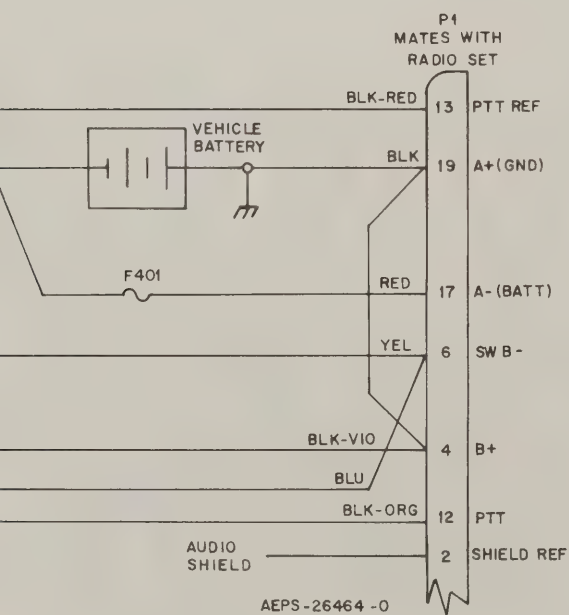
parts list

Hang-Up Boxes			PL-6063-A
CODE	MOTOROLA PART NO.	DESCRIPTION	
1	7C84568B02	BRACKET, trunion	
2	4S1724	WASHER, flat: 0.234" x 0.625" x .048"	
3	3S7302	SCREW, machine: 10-32 x 3/8" "Phillips" hex head	
4	15C84520C01 or 15C84520C02	HANG-UP CUP & SWITCH ASSEMBLY HANG-UP CUP (TLN4505A)	
5	3S135507	SCREW, machine: 6-32 x 3/4" "Phillips" hex head	
6	1V80717B42 or 1V80727B32	CABLE ASSEMBLY; includes attached insertable connector contacts (TLN4507A) CABLE ASSEMBLY; includes attached insertable connector cotacts (TLN4698A)	
7	42B82018H08	ANCHOR, cable strain relief	
8	4S1720	WASHER, flat: 0.156" x 0.378" x .030"	
9	1V80717B40 or 58D84514C01	MOUNTING BASE & SWITCH ASSEMBLY (TLN4507A) MOUNTING BASE (TLN4698A and TLN4505A)	
10	13B84515C01 or 13B84515C02	ESCUTCHEON (TLN4507A) ESCUTCHEON (TLN4698A and TLN4505A)	
non-coded items			
	42B82018H08	RETAINER, cable (TLN4698A)	
	3S136756	SCREW, tapping; 20 x 5/8" (TLN4698A)	
	38B84383D01	CAP, protective	

NEGATIVE GROUND MITREK CABLE MODIFIED FOR POSITIVE GROUND INSTALLATION



NEGATIVE GROUND MOCOM•70 CABLE MODIFIED FOR POSITIVE GROUND MITREK IN- STALLATION





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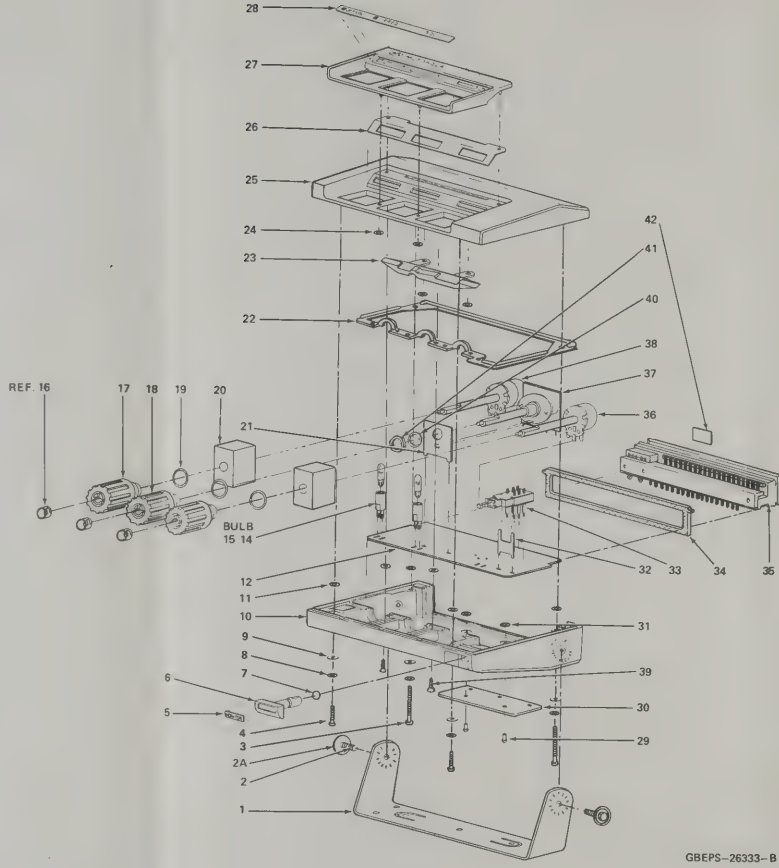
MITREK CONTROL HEAD
MECHANICAL PARTS

parts list

Control Head Mechanical Parts List				PL-6066-D
ITEM	PART NO.	DESCRIPTION	REMARKS	
1	7-80101AD1	bracket, trunnion		
2	3-130726	screw	for trunnion (two used)	
2A	4-135784	washer	for trunnion (two used)	
3	3-10903B62	screw, machine	for housing, rear (two used)	
4	3-10903B58	screw, machine	for housing, front (two used)	
5	33-80117AD1	nameplate (decals)	"MONITOR"	
6	36-80102AD1	pushbutton	"PL" models only	
7	36-80102A22	pushbutton	CS models only	
8	42-10126A22	"O" ring	weather resistant models only	
9	4-7655	washer, lock	for housing screws (four used)	
10	4-130280	washer, flat	for housing screws (four used)	
11	13-80109AD1	housing, bottom	for housing screws (six used)	
12	4-80109AD1	washer, captive		
13	84-80112AD1	printed circuit board		
14	9-80051801	light socket	w/o busy light option (2 used)	
15	85-80378AD1	light bulb	w/o busy light option, 3 used	
16	42-10062A14	retainer, knob	w/ busy light option, 3 used	
17	36-80107AD1	knob, vol., sq.	Installed by vendor (three used)	
18	36-80107A02	knob, freq.		
19	42-10126A23	"O" ring	weather resistant models only (3 used for multiple freq, 2 used for single freq)	
20	32-80206AD1	gasket	freq. switch	
21	7-80158AD1	bracket, freq. switch		
22	32-80003B01	gasket, housing		
23	61-80119AD1	lens		
24	42-10113A31	retainer ring	for bezel and lens (six used)	
25	15-80108AD1	housing, top		
26	32-80140B01	adhesive strip		
27	13-80180A01	bezel	for bezel, non-weather resistant models only	
28	13-80180A02	bezel	multi-freq., weather-resistant models	
29	13-80114A01	bezel	multi-freq., non-weather-resistant models	
30	13-80114A02	bezel	single-freq., non-weather-resistant models	
31	33-80116A02	nameplate (overlay)	for bezel (1-freq. models) w/o busy light option	
32	33-80116AD1	nameplate (overlay)	for bezel (4-freq. models) w/o busy light option	
33	33-80116A05	4-freq. with busy light		
34	53-80116A06	1-freq. with busy light		
35	5-7703	rivet	for strain relief bracket (two used)	
36	7-90100AD1	bracket, strain relief		
37	4-7555	washer, flat	for strain relief bracket (two used)	
38	7-80158AD1	bracket, p.b. switch		
39	32-80038CD1	switch, pushbutton	S103, see electrical parts list	
40	32-80038CD1	gasket, connector	weather-resistant models only	
41	32-80038CD1	connector	J101, see electrical parts list	
42	32-80038CD1	potentiometer	R102, sq., see electrical parts list	
43	32-80038CD1	rotary	S102, freq., see electrical parts list (multiple freq. models only)	
44	32-80038CD1	potentiometer, rotary	R101 (pro S103), see electrical parts list	
45	3-10906B04	screw, machine, flat	for housing, front (two used)	
46	4-7655	washer, lock	for frequency switch bracket	
47	2-1378	nut	for frequency switch bracket	
48	32-80131B01	gasket, mic	for weather-resistant models only	

non-referenced items		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-138013	SCREW, tapping, 8-18 x 1/2", 3 used
	3-138756	SCREW, tapping, 10-16 x 5/8", 3 used
	37-80118AD1	GROMMET
	36-84385D02	CAP, protective
	42-10113A32	RETAINER, ring

68P81039E24-C
(Sheet 2 of 2)
8/1/82-TP



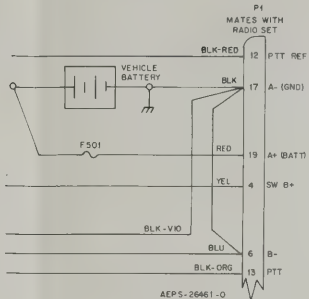
FIELD CONVERSION OF RADIO CABLES

In some instances, it may be necessary or desirable to make field conversion of cables to facilitate a particular installation. Two examples of this would be to install a new MITREK radio in a positive ground vehicle when only a negative ground cable was available or to retrofit a MITREK radio into an existing positive ground MOCOM•70 installation. In both of these the resulting cable should be clearly tagged as its wire colors will not match any existing documentation.

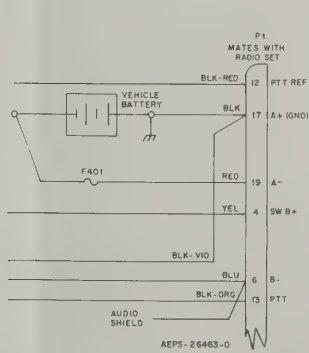
NOTE

When converting to positive ground, JU1 on the interconnect board in the radio must be cut.

NEGATIVE GROUND
MITREK CABLE



POSITIVE GROUND
MOCOM•70 CABLE



CONVERSION PROCEDURE

Step 1. Unsolder the wires from the following pins at the connector to the radio set:

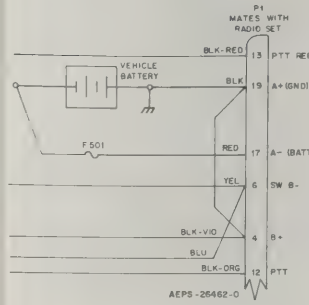
Wire Color	Pin
Blk-Red	12
Blk, Blk-Vio, Jumper	17
Red	19
Yel	4
Blu, Jumper	6
Blk-Org	13

Step 2. Resolder the wires to the following pins:

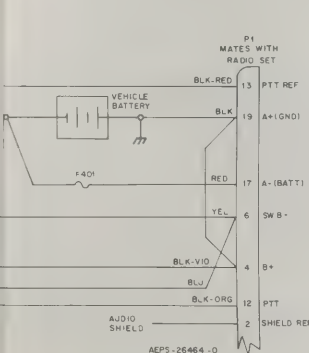
Wire Color	Pin
Blk-Red	13
Blk, Jumper	19
Red	17
Yel, Blu	6
Blk-Vio, Jumper	4
Blk-Org	12

Step 3. Attach a tag to the cable near the radio connector documenting the changes that have been made.

NEGATIVE GROUND MITREK CABLE MODIFIED
FOR POSITIVE GROUND INSTALLATION



POSITIVE GROUND MOCOM•70 CABLE
MODIFIED FOR POSITIVE GROUND MITREK INSTALLATION



*Blu lead may be omitted on single frequency models.

Step 2. Resolder the wires to the following pins

Wire Color	Pin
Blk-Red	13
Blk	19
Red	17
Yel, Blu*	6
Blk-Vio	4
Blk-Org	12
Audio Shield	2

*Blu lead may be omitted on single frequency models.

Step 3. Solder a short jumper (insulated #24 or larger wire) between pin 4 and pin 19.

Step 4. Attach a tag to the cable near the radio connector documenting the changes that have been made.



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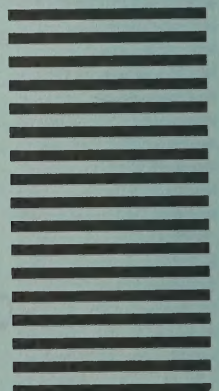


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